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BAND SAW MILLS FOR LOGS.

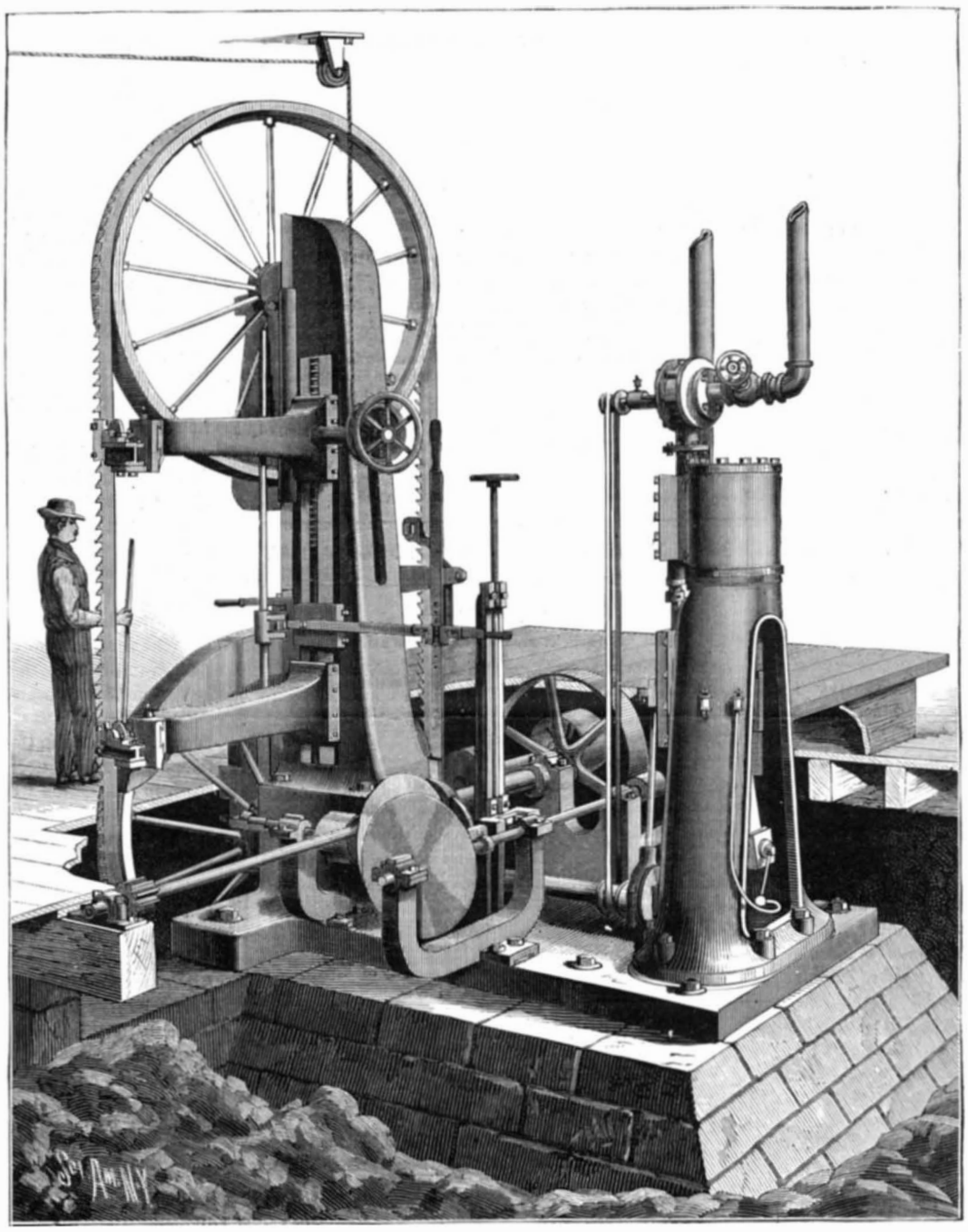
Some years ago we published a description of a band saw mill arranged for sawing logs, erected in New York city by the Atlantic Works, of Philadelphia. At that time such mills were little known, but the increasing demand for something more efficient and less wasteful than the circular mill has led to many improvements in band saw mills.

The wheels, the vital point of a band mill, are now eight feet in diameter, thus greatly reducing the flexure of the saw. They are kept as light as possible, consistent with great strength, these two points being essential—strength to withstand the great strain of the saw and lightness to reduce the force of inertia, and consequent sudden strain on the saw blade in entering the log.

The wheels are supported on steel shafts, and have bearings on each side close to the hub. The wheel shafts have ample provision made for adjustment in every direction, in order to permit of accurate alignment, and the adjustment of the upper wheel, which controls the position of the saw on the wheels, can be made while the mill is running.

The feed motion of the carriage is novel and beautiful, being powerful and yet capable of very wide variation. It consists of a delicate friction device, which is at the same time so powerful as to move the heaviest logs with ease. It is so completely under the control of the operator, that he can change the rate of feed instantly from zero to full speed, or alter the rate by an almost imperceptible variation.

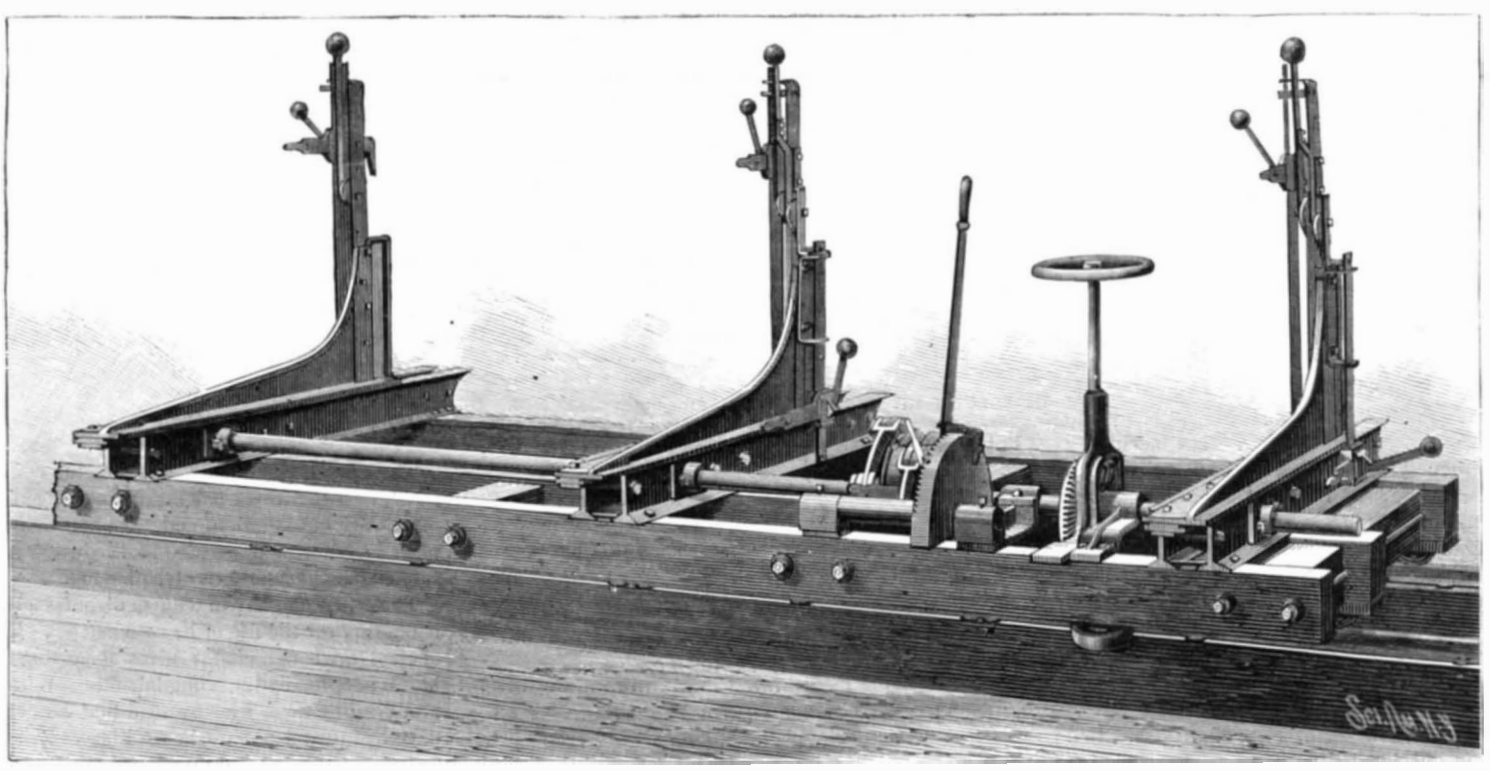
In order to avoid the loss of power experienced through friction and stiffness of belts, and as a superior mechanical construction, the mill is arranged to be driven by a vertical steam engine connected directly to the saw wheel shaft. The high rate of speed—300 revolutions per minute—at which the engine is required to run, calls for great care in this method of construction, but all obstacles have been successfully overcome. The entire mill, feed works, and engine, are bolted down to a massive sole plate, six feet wide and nine feet long, and the parts are made of such strength and rigidity as to insure the greatest stability. The engine is proportioned throughout for high speed, the working parts being capable of standing as high a mean effective pressure as a locomotive engine.



The guides are bored true with the cylinder, and the cross head pin is central in the cross head, permitting the pin to assume the position of least strain. The reciprocating parts are counterbalanced as far as possible, and the compression of the steam is so arranged as to take up all the shock arising from the inertia of the unbalanced weight. At 300 revolutions, or 600 feet, per minute, the motion is perfectly smooth and free from tremor. The position of the engine permits the operator to have complete access to all its parts without leaving the control of the mill. The engine is 10 inches bore, 12 inches stroke, and at 600 feet piston speed, with 70 pounds boiler pressure, will give ample power. All the parts of the engine can be oiled while in motion, and the bearing surfaces are so large as to run cool without requiring undue attention.

The saws used on this mill are about 50 feet long, 6 inches wide, and of the thickness known as 17 gauge. In order to strain such a saw to the tension required for cutting, the column and framing are made unusually strong. At first sight the mill appears heavy, but when the size of the saw is remembered, and also the fact that the mill can cut a log six feet in diameter, the proportions are seen to be correct.

A very important improvement in this mill, and one found in the same form in no other mill, is an attachment known as the saw deflector. This consists of a device so connected to the saw guides that when the motion



LONDON, BERRY & ORTON'S BAND SAW MILLS FOR LOGS.

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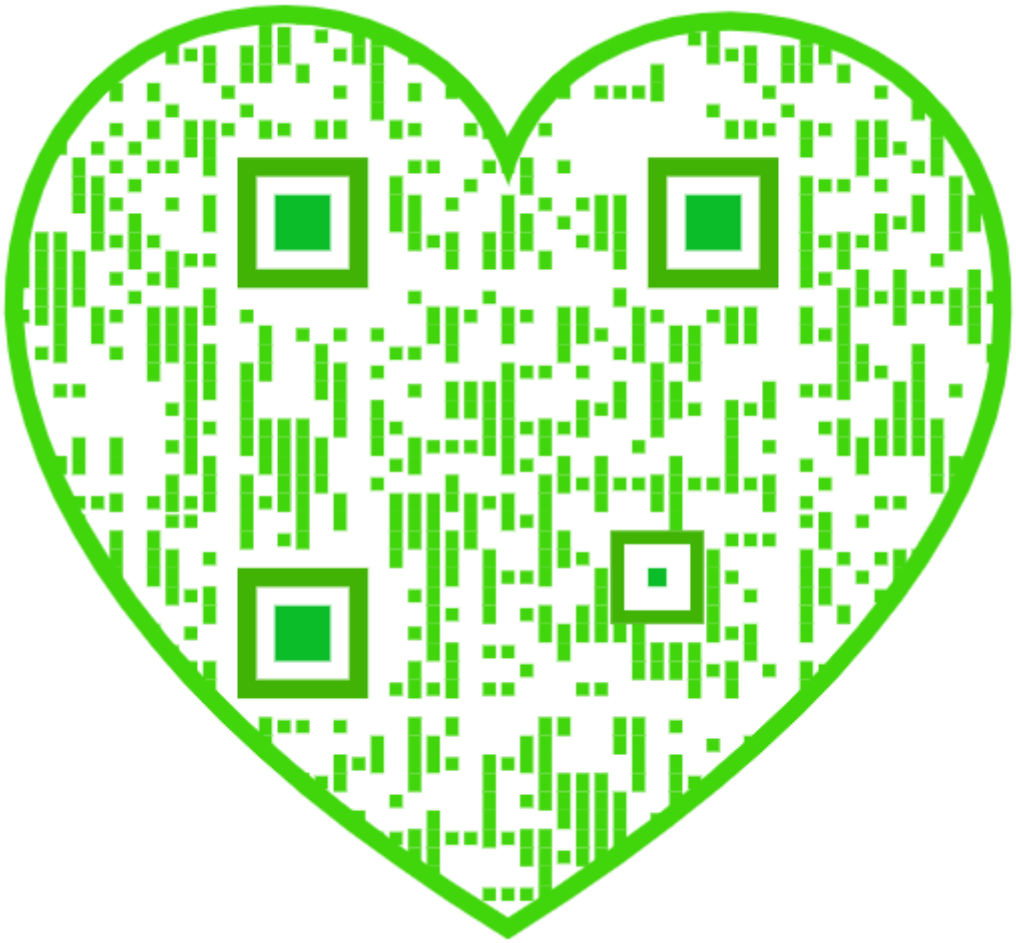

of the carriage is reversed, the saw blade is automatically drawn back about one-quarter of an inch from the freshly cut surface of the log, and retained in that position until the forward motion of the carriage begins, when the saw is instantly restored to its exact former position. The advantages of this are obvious. The saw does not scratch the surface of the log on its back motion, while at the same time the speed of the quick return movement can be greatly increased.

Before this attachment was made, the return motion of the carriage was twice as fast as the maximum forward feed; with the deflector attached the back motion has been easily increased to three times the forward feed. This may not appear at first sight so important, but the firm suggest the following calculation relative to this point: In a year of 300 working days, without the deflector, 200 will be spent in cutting and 100 in running back the carriage; while with the deflector in use 225 days will be spent in cutting and only 75 days in running carriage back, a clean gain of 25 days' sawing.

The carriage on which the log is carried, together with the head blocks and dogs for supporting and holding it, as well as the set works and rails on which the carriage runs, all merit attention. Four different kinds of carriages are made for these mills in order to meet the varying wants of customers, but the style shown in the illustration is the most complete.

The head blocks are each made of double wrought iron I-beams, planed true and carrying strong knees to which the dogs are attached. These knees are made to recede 44, 48, or 54 inches from the saw, as required. Motion is transmitted from the set works to the knees through a steel shaft, carrying cut steel pinions working in cut steel racks. The ratchet wheels in the set works have forged steel rims, the ratchet teeth being machine cut, thus insuring the greatest accuracy in every respect. This set works is graduated to set to sixteenths. After the log has been entirely sawed, the knees can be brought back by power while the carriage is running back, or a few turns of the hand wheel on the carriage will bring them back simultaneously.

The dogs used for holding the log are the celebrated Knight's patent upper and lower dog. These dogs are so well known that it is only necessary to say that the upper and lower dogs can be adjusted separately or together, and that they will hold a log or flitch when nearly cut up, so that it is impossible for the board to spring away from the knees, thus permitting a log to be cut up true to the last board.

The trucks under the carriage are strong and heavy, to stand the strain of loading and turning heavy logs, and the rails on which the carriage runs are made of railroad iron planed true. The rail nearest the saw is planed to a V-shape, while the other one is flat.

These mills are made also to be driven by belt instead of direct engine, and can then be driven from any suitable source of power.

Band saw mills as above described are suitable for cutting the finest lumber in the country—walnut, poplar, pine; saving a large amount of lumber which would otherwise be cut into sawdust by the wide kerf of the wasteful circular mill. Their capacity is rapidly approaching that of circular mills. Messrs. London, Berry, & Orton tell us that with good logs they can already average 20,000 feet of lumber per day, and expect soon to see the day when 30,000 feet will be cut on band mills. Those who are interested in the subject should write Messrs. London, Berry & Orton, Atlantic Works, 22d Street above Arch Street, Philadelphia, Pa. They make the entire plant for band saw mills, including all described above, as well as log turners, edgers, cut-off saws, and saw mill machinery generally.

The American Institute Fair.

The fifty-third industrial exhibition of the American Institute was opened in its great building on Third Avenue, New York, on Wednesday, September 24. There was an audience estimated at 5,000 to listen to the opening address of the President, Cyrus H. Loutrell, who was followed in a most interesting speech by Hon. Abram S. Hewitt. The latter declared that the wealth of the world had been multiplied a hundred fold within a hundred years, by the aid of intelligent invention and the work of skilled mechanics. Science, he said, and not legislation, was the great lever which produced happy men and women; science revolutionized society for the better.

The lists of exhibits and exhibitors at this year's fair outnumber those of any previous year. The central part of the building, which is an eighth of a mile in circumference, has a concrete floor. Conterno's Ninth Regiment band is to give a concert each afternoon and evening. The machinery will be in motion from 10 to 12 o'clock in the morning, 2 to 5 o'clock in the afternoon, and 7 to 10 in the evening. One of the most interesting exhibits is an incubator in which chickens will be hatched; the eggs have been placed in at such intervals that chickens are expected to be hatched hourly, when they will be placed under an artificial mother, so that on the last day of the fair, it is counted, there will be chickens hatched by artificial means on the premises from one hour to two months old.

THE prediction of M. Ch. Montigny, of Brussels, that the past summer would be a very dry one—a prediction founded on his observations of the change in the character of stellar scintillation—has been fulfilled to the letter.

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NEW YORK, SATURDAY, OCTOBER 4, 1884.

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THE GREAT TELEPHONE SUIT.

After four years of preliminary work, the great telephone suit between the American Bell and the People's Telephone Co. has reached a hearing. In the interest of the inventions themselves, in the magnitude of the amount involved, and in the number of witnesses and size of record, the suit has no parallel. The four years' work and the accumulation of the vast amount of testimony is amply justified from the standpoint of the first two considerations.

The history of the litigation may be briefly stated. It is a suit brought by the American Bell Telephone Company upon letters patent issued to Alexander Graham Bell, dated March 7, 1876, and January 30, 1877, against the People's Telephone Company, of this city. The possession of these patents has given the Bell Company the control of the telephone market. They sue the People's Company as infringers. In their defense the People's Company allege priority of invention on the part of Daniel Drawbaugh, and the issue of infringement is waived, the defendants practically admitting that they do infringe upon the Bell patents. The defendants claim that the invention of these patents was made at a period long prior to their date of issue, by Daniel Drawbaugh, of Pennsylvania. Hence they say that the patent should not have been issued to Bell, as he was not the first inventor. In this way the Bell Company is put on the defensive to protect its own patents, and the nominal defendant is really the aggressor.

Daniel Drawbaugh was a native of Pennsylvania. He was born at Eberly's Mills, in Cumberland Co., where he always resided. He was a mechanical genius of the universal type, turning his hand to a variety of work in demand in such a country region as the one he inhabited. He repaired guns and clocks, made furniture and machinery, and painted the wagons, and the portraits of their owners, for the surrounding region. In this way he made his living, devoting his leisure time to electrical experiments. He was never well off, and had much of his small stock of money swept away by the war.

In the year 1860, it is claimed he first conceived the idea of conveying human speech by electricity. He describes almost pathetically one of his early troubles. He needed a co-operator, some one to talk back and to listen at the experimental telephones. This assistant he found in his daughter, a girl only six or seven years old, who has since died. Her voice, the Drawbaugh people say, was the first human intonation heard through a telephone. In her, Drawbaugh says, he found an obedient and docile assistant, and a companion in his work that would not laugh at his dreams.

Various sketches and primitive apparatus have been produced by the defense, showing what are claimed to have been the early inventions of Drawbaugh; among them are a telephone transmitter made out of a tea-cup, designed to work in connection with an equally primitive receiver, in whose construction a tin mustard-can plays a prominent part. As shown these are not "lever's telephones" by any means, but are genuine electrical ones. The early date of 1866 is assigned to this tea-cup and mustard-can combination. But the inventor kept on the road to perfection, and for the year 1867 or 1868 we are presented with a more highly developed production, a transmitter made out of a jelly tumbler. All the apparatus thus far described was designed for use with a battery. In 1870 it is claimed Drawbaugh found out that a battery was not needed, and substituted therefor a permanent magnet. A horseshoe magnet was used in contact with the cores of two parallel bobbins. Then for two years the inventor is said to have devoted his energies to reducing the size of the instrument. In 1873 or 1874 he is said to have produced a very compact and efficient transmitter, which is still in excellent working order. It is in the shape of a flat cylinder, and is about five inches in diameter. During the time of the trial it has frequently been used on telephone lines with good success. A still more compact instrument is shown, which is said to have been made in January, 1875. In this a spiral magnet is employed, and the instrument is only three inches in diameter by an inch and a half thick. A pair of these in perfect working order are still in existence. Finally a very perfect and compact carbon transmitter, attributed to the early part of 1876, is shown, along with a larger one dated in August of the same year. The latter has recently been tried, and found to transmit sound uttered twenty-three feet from its opening.

One very impressive feature of these claims is the statement that such perfection as above described was reached at so early a date by Drawbaugh. For the first Bell telephones, exhibited less than ten years ago, were quite indistinct, and hard to use. The early perfecting of the invention, under the disadvantages due to isolation and poverty, if proved, will render Daniel Drawbaugh's name forever most illustrious.

The People's Company, alleging these facts in their defense, aver that Bell's patents are invalid and void from want of priority of invention, and aver that Drawbaugh was the prior inventor, and entitled to the broadest possible patent for the telephone and the telephonic art.

The Bell Company of course disputes all the proofs, and is fighting for the life of its own patents. This brief *resumé* of the Drawbaugh claims gives some clue to the line of rebuttal adopted by the complainants. Witnesses have been produced by them who testified that Drawbaugh could not have had the telephones in working order and in successful operation at the period mentioned without their knowledge.

The examination was conducted in various places, principally in Pennsylvania. Drawbaugh gave his testimony, in

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answer to ex-Judge Lysander Hill's interrogatories, in a little attic room in Harrisburg. Mr. Chauncey Smith, of Boston, conducted his cross-examination, extending through upward of one thousand questions and answers. The direct examination of the alleged prior inventor occupied some three weeks, while five were devoted to this cross-examination.

The testimony was mostly taken before one examiner, Mr. Frederick M. Ott, of Pennsylvania. He received some hundred pages of manuscript of testimony taken in Boston, and since then has written out the enormous number of eight thousand pages of testimony. This represents over eight reams of law-cap paper, and certainly beats the record.

Now, after these four years of work, the case has come to be heard on its merits in the Circuit Court of this district, before his Honor Judge Wallace. An immense amount of matter is presented for his consideration. The testimony and record as printed fill a number of large octavo volumes. They contain much besides the examiner's record, as they include various matters stipulated into the case. Probably over ten thousand pages are filled by the two sides.

The interest of the suit is, as before stated, largely due to the subject matter. The telephone is so marvelous a conception, that expatiation on the greatness of the original invention is superfluous. If all of Mr. Drawbaugh's claims be proved, a veritable chapter of romance will be added to the already romantic annals of invention.

The magnitude of the moneyed interest is also impressive. One hundred millions of dollars is given as the amount in controversy. This is no fanciful amount; the Bell Company really control and monopolize the telephone supply. If their patents are broken down, they will lose the monopoly, and will have to enter the field against fierce competition.

The public is apt to consider itself benefited by the breaking down of any monopoly. They do not realize that the *quasi* monopoly of patents is instituted for their profit, and insures them most advantageous results. Hence public sentiment will probably be found to favor the Drawbaugh claims, in the hope of breaking down the Bell monoply, and getting cheaper telephones. But this view, if taken, will be apt to prove a wrong one. The extensive development of the art is due to this protection, now menaced, and it is quite probable, if the Bell patents are declared invalid, that directly or indirectly the public will be the loser.

However, this is no place to argue the rights or wrongs of the case; the testimony is now before a United States Court, and a decision may be looked for at no very distant day.

The argument began on Monday, Sept. 22, 1884. It will last probably two or three weeks. The case for the complainants was opened by Mr. J. J. Storrow. At the present writing the defendant's side is being argued by ex-Judge Lysander Hill. The case was opened in the regular court room of the equity term of the Circuit Court, but the crowds that attended made a removal to a larger court room necessary. The noticeable feature of the attendance is the large assemblage of lawyers, as participants or spectators, within the bar. It is seldom, even on motion days, that the space is so crowded.

A note of the personnel of the trial is in place. The Bell Telephone Company is represented by the following array of counsel: Hon. Roscoe Conkling, Ed. N. Dickerson, Chauncey Smith, J. J. Storrow, and C. T. Howson. They produced as experts the following gentlemen: Prof. Charles R. Cross, of the Massachusetts Institute of Technology, F. L. Pope, Arthur W. Wright, and W. W. Jarnes. On the other side appear as counsel Hon. Geo. F. Edmunds, Hon. Lysander Hill, N. W. Jacobs, T. S. E. Dixon, and Melville Church. The expert was Mr. Park Benjamin. Both Prof. Bell and Mr. Drawbaugh have been present at times during the argument.

The total number of witnesses was over five hundred, of which nearly three hundred and fifty testified for the defense.

GRINDING MATERIALS.

The finest of emery cuts and leaves minute scores in the metal, particularly if the metal be soft; it is impossible to produce a good, polishable surface on silver with flour of emery; burnishing would be necessary to make a surface, and even then it would present a striated appearance under reflected light. Other grinding substances are required for some fine surfacing work. Moulding sand, that has been used in the foundry for some time, makes an excellent material for surfacing light brass—brass that contains a large proportion of zinc. Some excellent results are gained by the levigation of the sand—rubbing it under a muller on a stone (marble) slab, as paints are ground for the artist. By this means the foundry sand may be reduced to an impalpable powder, which, however, retains much of its abrading quality.

There is a manufacturer of fine tools in an Eastern city who uses coal ashes to give the last surface, before polishing, to his hardened steel tools. He takes the ashes of Lehigh coal, pours them into a tub of water, stirs them up violently, and, when the water is turbid with the fine ashes held in suspension, he draws it off into a shallow tank and allows it to settle. The sediment is his polishing powder. If a higher degree of fineness is required, the operation of stirring, and washing, and settling is repeated. The material thus obtained makes an excellent surfacing material.

In the manufacture of silverware (solid silver) the surfacing before burnishing is done by a blue clay, technically called "grit." It is found in several localities, particularly in the Connecticut River valley up to fifty miles from its mouth, in the vicinity of Middletown and Hartford. This clay appears to be the substance of which blue slate is formed, but is usually obtained in a semi-liquid form, and is dried for use. It is not surface clay, being found below the alluvium and sometimes below gravel, its depth or thickness of bed having been discovered, by boring for artesian wells, to be in some places more than sixty feet. Its identity with slate substance appears to be suggested by its behavior under heat, it assuming a stratified, porous form. It does not scratch pure silver, nor copper, nor mar coin gold, but it will not give a polish. It grinds without leaving a shining surface; this is produced by burnishing, by rubbing with whiting, chalk, or even with the bare hand.

ASPECTS OF THE PLANETS FOR OCTOBER.

JUPITER

is morning star, and by far the most brilliant of the shining throng that adorns the eastern sky, outmeasuring and outshining his fair rival Venus. The paths of the two planets lie near each other during the whole month, and their proximity affords the opportunity for some of the most charming exhibitions that these celestial wanderers are capable of producing.

Jupiter now rises about a quarter of an hour later than Venus. As he is apparently moving westward, and she is moving eastward, it is plain that with each successive rising the space between them will lessen until they meet. This event occurs on the 6th, at 11 o'clock in the morning, when Jupiter is 1° 15′ north of Venus. The planets are invisible at their nearest point of approach, but they will be near enough to each other on the morning of the 6th to make a lovely picture on the celestial canvas. They will rise together soon after 2 o'clock, and continue side by side on their shining course till the glowing dawn conceals them in the ethereal depths.

On the morning of the 7th they will present a new phase. Their relative position will be changed, Jupiter being west of Venus. The distance between them will go on increasing as each planet pursues its appointed course in a seemingly opposite direction. For Jupiter is approaching the earth in his progress toward opposition, growing all the while larger and brighter, and Venus is approaching the sun while receding from the earth, growing all the while smaller and less brilliant as she draws nearer to superior conjunction. Astronomers will have to lay aside Venus for the present as a subject for telescopic observation. Her white spots will shine no longer, for the rapidly waning crescent—the form she now takes on—will effectually hide her delicate markings from terrestrial observers.

There is, however, a compensation for those who take pleasure in the study of the queen of the sciences. When one planet retires from the field, another comes into prominence. Jupiter is now in favorable condition for the telescopist to wrest mighty secrets from his giant grasp. Has the great red spot vanished entirely beneath the all-encompassing clouds that swell his limits to such huge dimensions; or will another rift open a new path of exploration to his glowing neucleus; or what new discoveries will be noted in the process of world-making that is there taking place? We are sure to learn all the tidings that the best instruments in the hands of practiced observers can reveal.

When we speak of the conjunctions of two heavenly bodies, we mean that they are in the same right ascension or longitude, but not in the same declination or latitude. They will then rise together, but one may be north or south of the other. Thus, in the present conjunction of Jupiter and Venus, the planets are in the same right ascension, and will rise at the same time; but Jupiter is 1° 15′ north of Venus. If right ascension and declination are the same, in the case of planets, stars, and the moon, an occultation takes place instead of a conjunction. In the case of the sun and moon, the hiding of one luminary by the other is called an eclipse. These varied aspects are all illustrated on the October sky. For within the limits of the month, specially favorable for star gazing, there will be the conjunction of the two brightest planets of the solar family, the occultation of a bright star by the moon, a total eclipse of the moon, and a partial eclipse of the sun.

The right ascension of Jupiter on the 1st is 9 h. 58 m.; his declination is 13° 13′ north; and his diameter is 31″.

Jupiter rises on the 1st about half past 2 o'clock in the morning; on the 31st he rises a few minutes before 1 o'clock.

VENUS

is morning star, and though her brilliant face is becoming dim for a time, she still retains her power to please. Her path lies so near that of Jupiter that the history of the one during the month includes that of the other. We have already described the meeting of the two most brilliant gems of the planetary brotherhood on the 6th. The principal actors have a companion of lesser renown. The first magnitude star Alpha Leonis, or Regulus, is a near neighbor of both Venus and Jupiter, during the first part of the month, the yellow star contrasting finely in tint with the deep gold of Jupiter and the softer hue of Venus.

Venus is in conjunction with Regulus on the 7th, at 7 o'clock in the evening, being then 55 south of the star. At this time the bright trio will be almost in line, Jupiter being farthest north, with Regulus nearly between him and Venus.

The right ascension of Venus on the 1st is 9 h. 44 m.; her declination is 12° 46 north; and her diameter is 21·6″.

Venus rises on the 1st about a quarter after 2 o'clock in the morning; on the 31st she rises about 3 o'clock.

MERCURY

is morning star during the month. He reaches his greatest western elongation on the 5th, at 3 o'clock in the morning, being then 17° 58′ west of the sun. It is the last time during the year when he is favorably situated for being seen with the naked eye as morning star, and only sharp-sighted observers will succeed in picking him up. He must be looked for 8° north of the sunrise point, and 20° southeast of Jupiter and Venus. The best time for observation is an hour before sunrise.

On the 9th, at 3 o'clock in the morning, Mercury is in conjunction with Uranus, the latest comer among the morning stars, seeming to pass 1° 10′ north of his distant neighbor.

The right ascension of Mercury on the 1st is 11 h. 33 m.; his declination is 3° 56′ north; and his diameter is 7·4″.

Mercury rises on the 1st about half past 4 o'clock in the morning; on the 31st he rises not far from half past 6 o'clock.

SATURN

is morning star, and as he rises now at half past 9 o'clock in the evening, will soon be in convenient position for easy observation. His high northern declination and increasing brightness make him a prominent object, and one easily recognized. He has wandered away from the neighborhood of his last year's companions, Aldebaran and the Pleiades, but has now established himself midway between two bright twinklers, Capella on the north and Betelguese on the south. He is preparing his forces for a brilliant career in the coming winter.

The right ascension of Saturn on the 1st is 5 h. 55 m.; his declination is 21° 51′ north; and his diameter is 17·8″.

Saturn rises on the 1st at half past 9 o'clock in the evening; on the 31st he rises at half past 7 o'clock.

NEPTUNE

is morning star, and is in good position for telescopic observation. He may be found in the constellation Taurus, about 7° south of the Pleiades, and remains nearly stationary during the month. A good instrument directed toward that part of the sky will quickly reveal the presence of the far away planet in the form of a small round disk.

The right ascension of Neptune on the 1st is 3 h. 24 m.; his declination is 16° 47′ north; and his diameter is 2·6″.

Neptune rises on the 1st soon after half past 7 o'clock in evening; on the 31st he rises soon after half past 5 o'clock.

URANUS

is morning star. He encounters Mercury, who is oscillating eastward toward the sun, and they are in conjunction on the 9th, the only contribution made by Uranus to the incidents of the month.

The right ascension of Uranus is 11 h. 58 m.; his declination is 0° 56′ south; and his diameter is 3·4″.

Uranus rises on the 1st about 5 o'clock in the morning; on the 31st he rises about half past 3 o'clock.

MARS

is evening star, and enjoys the distinction of being the sole planet on the sun's eastern side, his six companion planets being congregated on the sun's western side as morning stars. He may be found in the constellation Libra early in the evening, where he shines as a faint reddish star.

The right ascension of Mars on the 1st is 14 h. 40 m.; his declination is 16° south; and his diameter is 4·6″.

Mars sets on the 1st at 7 o'clock in the evening; on the 31st he sets at half past 5 o'clock.

THE MOON.

The October moon fulls on the 4th at 5 o'clock in the evening, standard time. The moon is in conjunction with Neptune on the 7th, and with Saturn on the 9th. She makes her nearest approach to Jupiter on the 14th and to Venus on the 15th, when the brilliant planets and the waning crescent will form on successive mornings pictures which one never tires of beholding. On the 16th the moon is near Uranus, on the 17th near Mercury, and our fair satellite completes the circuit by paying her respects to Mars three days after her change.

OCCULTATION OF BETA CAPRICORNI.

On the 26th, the day before her first quarter, the moon occults the third magnitude star Beta Capricorni. If the weather prove favorable, the interesting phenomenon will be easily visible. The immersion of the star will take place at 19 minutes after 9 o'clock in the evening, Washington mean time. The occultation will last 58 minutes, and the immersion will take place at 17 minutes after 10 o'clock. The observer will see the star suddenly disappear behind the moon's dark edge. It will remain hidden from view nearly an hour, when it will suddenly reappear on the moon's bright edge, and star and moon will rapidly recede. The moon is frequently occulting small stars, but she does not often capture so large a prize as Beta Capricorni.

TOTAL ECLIPSE OF THE MOON.

There will be an eclipse of the moon on the 4th, visible as a total eclipse in Europe, Asia, Africa, and the Atlantic Ocean. Dwellers in this vicinity will enjoy the latter part of the show, for the moon will rise eclipsed, and the eclipse will end about 6 o'clock.

ECLIPSE OF THE SUN.

There will be a partial eclipse of the sun on the 18th, invisible in the United States, but visible in Western Europe and Asia. Our loss in being on the wrong side of the earth when the event takes place in not very great, as only 0 639 of the sun's diameter is eclipsed.

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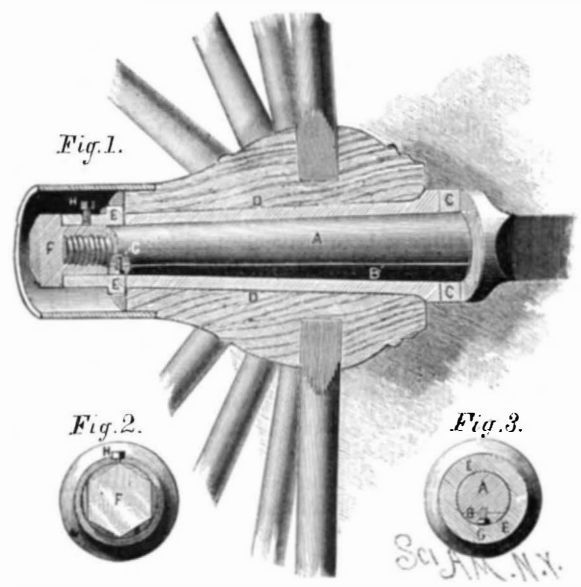
AN IMPROVED AXLE.

The under portion of the journal, A, is made flat, and the outer end is screw threaded in the ordinary way. Applied to the flat surface is a wearing plate, B, which is held in place by the washer, C, collar, E, and by the screw, G, which enters a countersunk hole in the plate, as shown in the cross section, Fig. 3. The nut, F, fits within the collar and screws upon the end of the axle to hold the wheel in place; by means of the set screw, H, the collar may be confined to the nut at any desired position. In ordinary use the nut and collar act together as a single nut, but when the thimble, D, becomes worn at the end, the collar may be shoved forward upon the nut by loosening the set screw. When the wearing plate becomes worn so as to be too small for the thimble box of the wheel, it can be easily removed and replaced by a new one, thus always insuring the true running of the wheel.

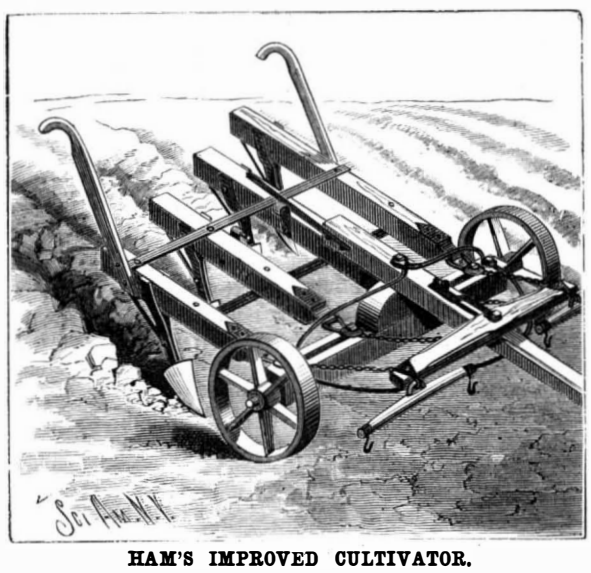


GREGG'S IMPROVED AXLE.

This invention has been patented by Mr. T. E. Gregg, of Mineral Springs, S. C.

AN IMPROVED CULTIVATOR.

In the wheeled cultivator patented by Mr. E. R. Ham, of New Market, Ga., a number of plow beams are secured to the axle and arranged side by side with flexible connections, to adapt them for various movements independent of the axle and of each other. The axle has a central arch to which the tongue is rigidly secured, and is formed with slots on each side of the arch, which are equal in length to the greatest distance between any two of the beams, which are flexibly connected to loops pivoted to the axle by bolts and nuts. This permits both a vertical and lateral movement of the beams, which is very desirable in stumpy land, and where the soil is wet and softer in some places than in others. The beams are connected to each other by flexible cross bars made of sheet metal. These bars are pivoted to the beams so that by moving one of the outside plows by its handle all the beams will be moved simultaneously in the same direction. This construction is important, since both handles owing to their distance apart, cannot be held by one man at the same time. The standards to which the plows are attached are slotted to receive the beams. The tongue is provided with a rear projection, upon which the beams are supported by means of hooks when the cultivator is not in actual use.



HAM'S IMPROVED CULTIVATOR.

Membrane of Egg for Skin Grafting.

In a case of extensive burn unhealed after six years, Dr. Frank C. Wilson, of Louisville, Ky., in *Med. News*, says: "I made use of three different kinds of skin grafts, namely, from the skin of a young rabbit, from the human skin, and from the inner membrane of a perfectly fresh hen's egg." Of the three he much preferred the egg membrane as being much more readily obtained, and one egg will supply any number of grafts needed.

Remarkable Intelligence and Heroism of a Dog.

The large Newfoundland dog Heck, belonging to the St. Elmo Hotel in the oil town of Eldred, Pa., was known throughout the northern oil field for its great strength and almost human intelligence. The porter of the hotel, a kind hearted but intemperate person, was an especial favorite with the dog. The porter, a small man, slept in a little room back of the office. The dog slept in the office. On the night of Sept. 18 last, the porter was drunk when he went to bed, and soon fell into a heavy sleep. Some time in the night he was awakened by the loud barking of Heck, who was jumping frantically on the porter's bed and seizing the pillow with his teeth. The still drunken and drowsy porter tried to make the dog go away, but the animal persisted in his efforts, and it finally dawned on the befuddled mind of the porter that the house was on fire.

His room was full of smoke, and he could hear the crackling of the flames. He sprang from the bed, but was still so drunk that he fell to the floor. The faithful dog at once seized him by the coat collar, the porter not having removed his clothing on going to bed, and dragged him out of the room and half way to the outer door of the office, when the man succeeded in getting to his feet, and, unlocking the door, staggered into the street. The fire was rapidly spreading over the building, and the hotel was filled with guests, not one of whom had been aroused. The dog no sooner saw that his helpless friend was safe than he dashed back into the house and ran barking loudly upstairs.

He first stopped at the door of his master's room, where he howled and scratched at the door until the inmate was made aware of the danger and hurried out of the house, as there was no time to lose. The dog gave the alarm at every door, and in some instances conducted guests down stairs to the outer door, each one of these, however, being a stranger in the house, which fact the dog seemed to understand in looking out for their safety. All about the house seemed to have lost their heads in the excitement, and it is said that the hotel dog alone preserved complete control of himself, and alone took active measures to save the inmates of the house. In and out of the burning building he kept continually dashing, piloting some half-dressed man or woman down stairs, only to at once return in search of others. Once a lady with a child in her arms tripped on the stairs while hurrying out, and fell to the bottom. The child was thrown on the floor of the hall some distance away. The woman regained her feet, and staggered in a dazed way out of the door, leaving the child in the midst of the smoke that was pouring from the office door. The brave dog saw the mishap, and jumping in through the smoke, which was now becoming almost impassable, and seizing the child by its night clothes, carried it safely out.

Notwithstanding this rescue, the mishap that made it necessary led to the death of the noble animal. The mother of the child on being restored by the fresh air first became aware that the child was not with her, and crying out wildly that "Anna was burning up in the house!" made a dash for the building, as if to rush through the flames to seek her child. Heck had already brought the little one out, but it had not yet been restored to its mother. The dog saw the frantic rush of the mother toward the burning building and heard her exclamation that some one was burning up in the house, and, although the building was now a mass of smoke and flames inside and out, the dog sprang forward and, as a dozen hands seized the woman and held her back from the insane attempt to enter the house, disappeared with a bound over the burning threshold. The faithful animal never appeared again. His remains were found in the ruins. There is no doubt in any one's mind that but for the intelligence and activity of Heck the fire in the hotel would not have been discovered in time for a single inmate to have escaped from the building with his life; and that the noble animal understood from the half-crazed movements of the child's mother that there was still another one in danger, and to rescue whom he gave his own life, is accepted as certain. The remains of Heck were given a fitting burial, and his loss is regretted as that of a useful citizen might be.

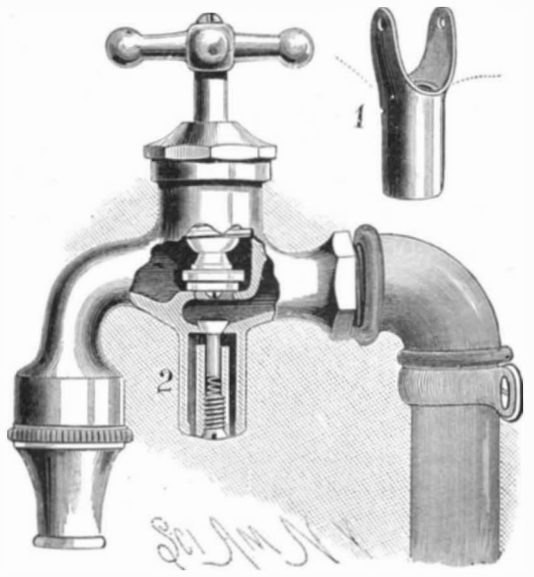
Diamond Turning Tools.

It is sometimes desirable to reduce the dimensions of a hardened steel article that has received a lathe finish without first drawing the temper, as this necessitates a rehardening and retempering. The usual method of lathe reducing of hardened steel articles by corundum wheel grinding is necessarily confined to straights or tapers, no offsets, collets, or shoulders being amenable to this style of work. A model maker and bright mechanic has succeeded in utilizing the black diamond, or bort, as a turning tool for hardened steel. He places a crystal in the end of a piece of iron or brass for flat turning, and one on the side of the end, or on a corner of the end, for side or shoulder turning. He has succeeded in doing some good work with these crude-looking tools.

The chips taken from the hardened steel are literally chips, not turnings, and are very minute. But viewed under the microscope they are seen to be cut from the hardened steel, and not merely disengaged crystals. One of the specimens of work with these bort tools is a well finished V-thread, about 32 to the inch. Two differing crystals of the diamond were employed to cut and true the thread. An adaptation of bort tools to the planer is evidently possible, and there seems to be no reason why its use might not be extended with economical results in the treatment of hardened steel and of chilled iron.

IMPROVED FAUCET.

The faucet shown in the engraving is so constructed as to prevent the water from standing in the pipes after the supply from the main has been shut off. The faucet may be of the ordinary pattern. The outer case of the automatic draining attachment is arranged at the lowest point beneath the body of the valve, and may be cast with the faucet or attached to those already in use. When made separately, it may have a jaw-like form (Fig. 1) on its upper end to hug the sides of the body, to which it may be held by set screws. A valvular vent-stem is arranged to close an orifice in the bottom of the body, and is kept closed by the water in the faucet when exposed to the full pressure of the supply. The stem is raised by a spring when the pressure is reduced by shutting off the supply; and by means of an adjusting screw upon which the spring rests, the tension of the latter may be so regulated as to adapt the device to different pressures. The screw and spring are contained within an inner tubular projection, within the case, which serves as a guide for the stem. Outside of this projection is a passage communicating below with any number of escape holes in the bottom of the case.



ALLWOOD'S IMPROVED FAUCET.

When the supply is shut off the valve stem will be raised by the spring, thereby allowing the water to drain out of the faucet and its connecting pipe, the escape being made through the orifices. In this way the device is automatic, and frozen water pipes within the building are prevented, supposing all the faucets to be similarly constructed.

Further particulars may be obtained by addressing the patentee, Mr. Arthur Allwood, of 381 Pleasant Street, Fall River, Mass.

DUMPING CAR.

The car herewith shown is for carrying coal, gravel, etc., and is so made as to permit dumping of the load at either side. The body is composed of ends and sides, which are hinged at their upper edges to side rods connecting the ends. The lower edges of the sides are curved inward, so that they unite when closed to form a tight receptacle with a rounded bottom. Fixed to the frame beneath the body are slide boards placed to form a double incline, the apex of which is at the center; these slides extend out far enough to carry the material beyond the wheels and track. The sides are held closed by pivoted bars, that engage notched pieces attached to the ends. The shape of the body is such that the pressure on the sides will throw them open as soon as the latches are released. It will be seen that the load may be thrown upon either side, or may be divided by opening both sides at once. Each end of the car is provided with a handle and hook, for hand use and horse power respectively.

SHERROD'S DUMPING CAR.

This invention has been patented by Mr. B. W. Sherrod, P. O. Box 156, Birmingham, Ala.

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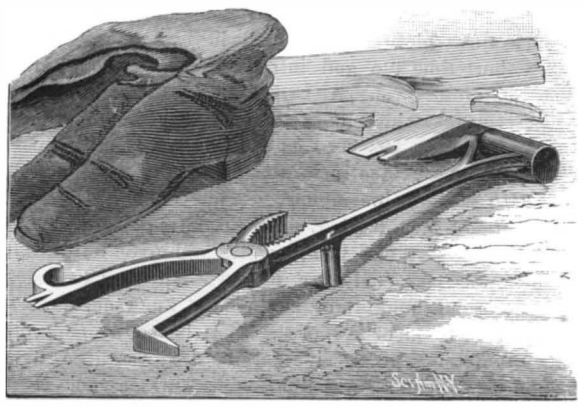
COMBINATION TOOL.

A combination or universal tool for household use recently patented by Mr. George B. Gable, of 1518 Jones St., Omaha, Nebraska, is shown in the accompanying engraving. The hatchet has a malleable iron handle, and is made with a notch for drawing nails. The outer end of the handle is curved to one side, and an arm of corresponding shape is pivoted to the handle, so as to form a boot jack and box holder. The extreme end of the handle is of flat form for use as a stove lifter, notched to serve also as a tack puller, and at one side is a hook for lifting pots. On the outer end of the other arm is a straight hook for use in regulating



GABLE'S COMBINATION TOOL.

stove doors and for use as a screw driver; this arm has a roughened tail piece for use, in connection with the handle, as a nut cracker or wrench. The tool thus constructed is inexpensive, and can be used for twelve distinct purposes, most of which are generally performed by separate tools.

Porosity of Wood.

An unpainted wooden pail showed some of its staves saturated and others nearly dry. Experiments with wood of the same character—the cucumber wood—showed that pieces sawed from the same board differed in their absorptive qualities as one end or the other was set in water, the trials appearing to suggest that when the wood was placed in water as it grew, butt downward, the water was absorbed more rapidly than when the position was reversed. As a further test two pieces were taken from the same board, and both painted on the outside—both faces—but one had the top end also painted, and the other the bottom, or butt end, painted. The one with the unpainted butt filled and sank, while the other floated. Perhaps differing results would have been obtained with differing woods. The fact of position affecting saturation seems to be recognized in the frequent custom of reversing fence posts from their natural position and in the driving of piles.

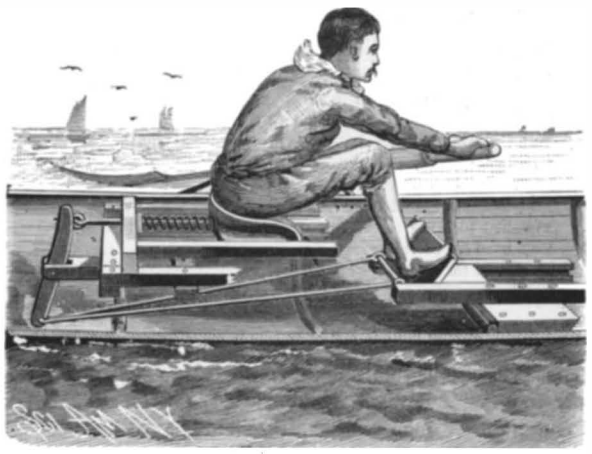
If a man empties his purse into his head, no man can take it away from him. An investment in knowledge always pays the best interest.—*Franklin.*

SEAT AND FOOT BOARD FOR ROW BOATS.

The sliding seat, of the usual construction, slides between two tracks held on a suitable frame. From the back of the seat projects a rod whose rear end is pivoted to the upper end of an upright lever pivoted to a bar projecting from the rear of the frame. A spiral spring, surrounding the bar, is held between the rear of the seat and a cross piece. The foot board is secured to a cross piece sliding in longitudinal grooves formed in plates in the boat. The lower end of the lever is connected by rods with the foot board. The pressure of the spring can be varied by a collar on the rod back of the seat.

When the oarsman makes a stroke, the seat is moved back and the spring is compressed, and the rod is moved in the same direction, when by means of the lever the foot board is moved in the opposite direction. As the oarsman recovers, the spring expands and pushes the seat back while the foot board is drawn forward, thereby relieving the oarsman of the necessity of pulling back the seat, and enabling him to expend all his force and power on the stroke. The recovery being very rapid, fast rowing is admissible.

This invention has been patented by Mr. James J. Turpel, of North Starr Street, Halifax, Nova Scotia, Canada.



TURPEL'S SEAT AND FOOT BOARD FOR ROWBOATS.

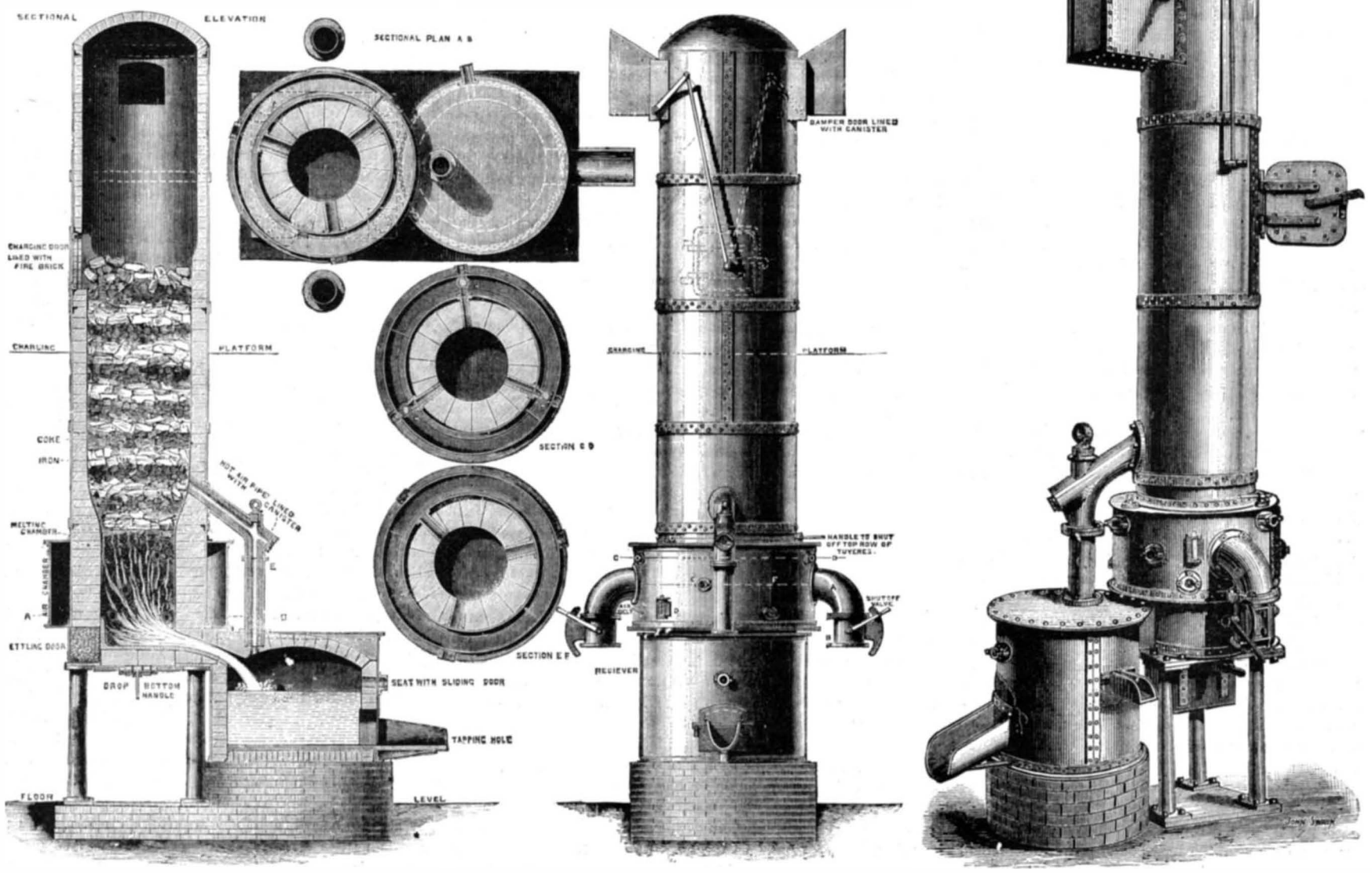
IMPROVED "RAPID" CUPOLA.

The cupola illustrated by the accompanying engravings is made by Messrs. Thwaites Brothers, of Bradford, Eng., under Stewart's patent. It will be seen that it is of the receiver class—the receiver is separate from the cupola.

The shell of the cupola is of plate iron with butt joints, covered with strips and rings, and riveted together with cup head rivets outside, the heads inside being flattened to allow the brick lining to fit close to the shell, which is of one diameter and parallel inside. There are several rings of angle iron inside shell in the length of the cupola to support the lining. To the shell is attached an annular air belt. Referring to the engravings, which are from *The Engineer*, it will be seen that on each side of the air belt is secured a cast iron quarter bend blast pipe, and to each bend is connected a turned shut-off valve. Inside the shell, and communicating with the air belt, are three rows of cast iron tuyeres. The two bottom rows each consist of three tuyeres, and the top row of six tuyeres. All the tuyeres are fastened to the shell with bolts and an asbestos ring. Opposite each of the top tuyeres in the air belt is fixed a cast iron shut-off turned plug valve. The plugs of these valves come through cover plates fixed upon the top of belt. All the plugs are fitted with small sprocket wheels, and are connected to each other with Ewart's malleable chain, so that all can be controlled from one handle at any convenient position. Opposite each tuyere is fixed a seat with sliding door, fitted with blue tinted glass peep holes. In front of each glass is a mica disk. Upon the air belt is a blast pressure gauge to indicate the pressure of air in cupola. The upper part of cupola above the belt is provided with charging door—fire brick lined—and with damper door and shield at the top on one side. The cupon stands upon a cast iron base plate. This base plate is fitted with a wrought iron hinged drop bottom door, in halves, opening from the center. Each half of the bottom is connected to a shaft, on which is fixed a wrought iron hand lever. A strong wrought iron bolt is shot across the door when closed, securely retaining it in position. A fettling door is provided at the back of the cupola. The base plate of the cupola is supported by four cast iron pillars upon a strong cast iron bed plate. The receiver shell is also made of plate iron, with angle iron ring, top and bottom, and cover plate on top; and provided, as shown, with tapping hole, spout, and fettling door, slag hole and spout, and hot air pipe and plug to convey hot air from the top of the receiver into cupola.

Several advantages as attending the use of this cupola are claimed by the makers, not the least important of which is its speed. According to the experiments of Dulong, 1 pound of carbon, combining with the necessary quantity of oxygen to form carbonic acid, develops 12,906 units of heat. The specific heat of cast iron being about 0 13, the melting point 2,190 degrees, and the coke containing 82 per cent of carbon, then to heat a ton of cast iron of a temperature of say 40 degrees to a temperature of 2,190 degrees would require

$$2190-40=\frac{\text{Heat}\quad \text{Iron Sp. heat}}{\text{2150} \times \text{2240} \times \text{0·13}}{\text{12906} \times \text{0·82}}=59\text{·1 lb. coke.}$$



IMPROVED RAPID CUPOLA.

This is supposing that the whole of the carbon is converted into carbonic acid; but if by any means carbonic oxide is formed, a very different result is obtained. Then 1 pound of carbon burning to carbonic oxide only evolves 4,453 units of heat. If, however, by admitting air above the zone where the oxide is formed, we recover 4,478 units, this + 4,453 gives 8,931. This is a little over two-thirds of the available heat to be got out of 1 pound of carbon, allow-

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ing 10 per cent for moisture in the coke, 10 per cent for radiation, or 40 per cent in all. The amount of coke per ton of metal should not exceed 112 pounds, although the actual consumption is usually much higher. On this point we may quote the following result of a blow made on the 8th of March last at Messrs. Rushforth and Co.'s, St. James Foundry, Bradford, with a cupola 4 feet in diameter and 19 feet length of shell:

	Time.		Charge of coke in lb.	Charge of iron in lb.
Time of lighting fire	10:0	A.M.	Bed 336	1792
Put in coke for bed of cupola	10:30	"	" 112	2,016
Making up of door	11:0	"	" 112	2,016
Commenced charging	11:5	"	" 112	2,016
Filled up cupola	12:30	P.M.	" 112	2,016
Commenced blasting	1:5	"	" 112	2,016
Metal running down	1:15	"	" 112	2,016
Took away first metal in 35 min. after blasting	1:40	"	" 112	2,016
2d metal taken	2:15	"		
3d do. do.	2:30	"	1,232	17,920
4th do. do.	2:35	"		
Finished Charging	2:15	"		
Finished blasting	2:35	"		

Fuel used for bed coke..... 336 lb.
Fuel used for fusion coke..... 896 lb.
Total consumption of fuel..... 1,232 lb.
Amount of iron melted in cupola..... 17,920 lb.

The speed of the blower was from 425 to 430 revolutions per minute, and the pressure varied between 29 inches, 32 inches, and 37 inches of water. The above figures show that 8 tons of iron were melted with 1,232 pounds of coke in one hour and a half, time from starting to finishing blowing. The time taken to melt the iron after having taken away the first ladleful of metal from the receiver to taking away last metal was 55 minutes. This gives 14·54 pounds of iron to 1 pound of coke, or, taking the coke used, exclusive of the bed coke, namely, 896 pounds, and weight of iron melted, 17,920 pounds, we have 1 cwt. of coke per ton of iron, and the makers say that the cupola will never "make up" if care is taken in charging 1 cwt. of coke per 18 cwt. of iron.

It is unnecessary to say anything further as to the economy of the cupola in working, but it may be mentioned that it is claimed that less blast is used, as it has not to traverse so heavy a mass as in the ordinary cupola, that the wear and tear is less, and that the melted metal is obtained freer from impurities, while it is made hotter.

In their description the makers observe that the bottom of the cupola is raised up to the tuyeres, so that the metal as fast as melted runs straight into the receiver. "The hot blast also enters receiver at the same pressure as the inside of cupola furnace. This blast agitates and mixes the metal in receiver, and then the hot air from receiver is carried back through a vertical pipe into the cupola, above the belt, and is by this means utilized in heating up the iron in upper part of cupola. The receiver, which is applicable to new or existing cupolas, enables such a quantity of molten metal to be stored up and kept to a proper temperature that with an ordinary sized cupola large steam hammer blocks may be cast with the same ease and certainty as smaller castings, and at the same time the metal may be held in reserve for any required length of time while the moulds are being prepared. It will be noticed that as the blast is diverted in its course, and does not entirely pass through the charge, the coke or fuel is not consumed before it is required for melting the metal, and hence a much smaller quantity of fuel is required to melt a given quantity of metal." Some of the cupolas are being fixed in France for the Thomas-Gilchrist steel process, and they have also been introduced for smelting copper ores. The metal, in the latter case, is run into large portable receivers, and is then taken to other refining furnaces, or run into the ingot direct.

The following, on introducing fine slack coal in the blast as mentioned by the makers, is of interest: In the United States pulverized coal and fine slack have been used in cupolas. The practicability of this utilization of a comparatively waste product was discovered in the following manner: There had been some trouble through scaffolding in the cupolas, and, to melt down the "salamander," the manager withdrew the tuyere pipes, rammed in a lot of small coal through the tuyere holes, and again put on the blast. The scaffolding was removed in a very short time, and the work proceeded as usual. The blast pipe was then perforated, and a small quantity of fine coal was supplied to the cupola through the tuyeres, which it was found not only prevented scaffolding, but caused the cupola to work much more rapidly. The great waste in melting iron in a cupola usually occurs at the zone of the tuyeres, on account of the large quantity of air blown in, and the absence of carbonic oxide at that point. What little carbon the air comes in contact with at this point forms carbonic acid, which is almost as destructive to the iron as free oxygen. The principal waste of the metal occurs after its fusion, and in its passage through this carbonic acid and atmosphere. By the injection of the fine coal with the blast its combustion is secured at the zone of the tuyeres, producing carbonic oxide, and thus preventing the oxidation of the descending metal. Beyond saving the waste of iron by this improvement, a much larger percentage of the carbon which the pig contains is transmitted to the converter, an advantage which would also be of great value in all cupolas for melting iron for castings; as the chief difficulty in that line is that the carbon is burnt out of the metal, and metal thus prepared is said to run more fluid and to produce finer and tougher castings than that melted in the ordinary manner. The following from the directions for lining is also worth quoting: "The durability of fire bricks depends largely upon the amount and quality of the fire clay used in laying them, and the way they are fitted together. If wide spaces are allowed, and too much fire clay used, there is shrinkage in the first heat, the bricks are attacked on all sides, and the key or wedge of the brick is lost. Only use the best fire clay; thin it with water to the consistency that will allow the brick to be dipped; fit the bricks so closely that, being dipped, they will take up sufficient slip to make the joint when rubbed together; fill all spaces with the thin slip, and dry with a slow fire."

SELF-ACTING SPRING LEG BRACE.

The engraving represents a self-acting spring leg brace which the inventor guarantees will cure any knee-sprung or ankle cocked horse in a few weeks.

Laced at the knee joint is a strap, to the opposite sides of which are attached the ends of a metal band which is so curved that it touches the band only at the ends. Secured to this band are the ends of two springs which pass down

COTE'S SELF-ACTING SPRING LEG BRACE.

and under the foot, being kept from spreading by a metal clasp, and being held securely in place by being passed through holes in the rear corks, nuts being screwed on the ends. The construction of the device and the way it is applied are very clearly shown in the cut. The tendency of the springs is to force the knee back to its normal position, and straighten the leg.

Further information may be had by addressing the patentee, Mr. Alphonse Cote, 850 Seventh Avenue, New York city.

The Ohio Earthquake of September 19.

The earthquake in England, April 22, and that along our eastern seaboard, August 10, have now been followed by one whose effects were felt in every quarter of the State of Ohio, about half of Indiana, and the southern part of Michigan. It covered an area of about 100,000 square miles, although in many places within this area it was not noticed at all, and in many others so slightly that people did not suppose there had been any shock until informed of its occurrence in other localities.

The time of the earthquake is variously given at from 2:40 to 3:30 on the afternoon of September 19, the differences in time being probably somewhat owing to the differences in timepieces. In Cleveland three distinct shocks were reported, the vibrations seeming to pass from west to east, and lasting from fifteen to thirty seconds. At Defiance, Ohio, it is said the swaying of buildings was so violent as to cause much consternation, and that a Methodist conference in session in one of the churches immediately adjourned, the members rushing to the street. In Cincinnati there was only a slight shock.

In Indiana the shock was felt at Indianapolis, Fort Wayne, Seymour, Lawrenceburg, and many other places, the effect being very plain in Lawrenceburg.

At Detroit, Mich., the shock was plainly felt, the Chamber of Commerce building being violently rocked, while in several buildings men rushed out on the streets in their shirt-sleeves, looking anxiously around as if they expected to see the structures toppling to the ground. At Dresden and London, Canada, the most northerly points where the earthquake was felt, the tremor was but slight.

The observations made are locally reported in a very indefinite and unsatisfactory form. Even though no material damage seems to have been done at any point, this earthquake may well serve to direct more earnest attention to the study of these disturbances. Instruments for registering earthquakes have now been so perfected as to automatically register the slightest vertical or horizontal movement, giving their direction, with the duration and exact time of occurrence, and such instruments are now in use in many places in Europe. With their aid there would be no difficulty in determining the extent and force of an earthquake wave, and we trust our leading educational institutions will not hereafter think them entirely unworthy of a place among their scientific apparatus.

The International Electrical Exposition, Philadelphia.

(FOURTH PAPER.)

European visitors to the Exposition have expressed, from time to time, no little surprise at the discovery of improvements made by American electricians and mechanicians in apparatus which were invented in their own countries only a short time ago, and introduced there, though in a somewhat crude form. At various points of the building is to be seen that which only through the interposition of Yankee ingenuity has been enabled to completely accomplish what was evidently in the mind of its original designer. That idea, incomplete, was his. It represents, perhaps, years of mental labor. But the mechanism by which it is adjusted with nicety to its work, and made to fulfill its mission, was perfected by a man who, it may be, never had an original thought, or, having one, knew not how to express it in wood or iron or steel. It is readily conceded that, in making practical what before was little more than an idea, he performs a valuable work, as does every man who produces that which tends to increase the happiness or lighten the labors of his fellows. But, when it is remembered that the same mind which conceived the improvement or laboriously plodded it out by experiment might, if properly trained and directed, have originated something of equal value, it is to be deplored that it should be restrained within the narrow limits of practicability.

On the other hand, the foreign exhibits, when compared with our own of similar character, are for the most part cumbersome and intricate. The American electrician, like the American mechanic, is always seeking after simpler methods and reduction of parts. He is so well known for his success in this pursuit that American mechanical models are, in some fields, used abroad as *criteria*.

In engine building, for instance, this is especially true. American engineers, though perhaps less scientific than those of England or the Continent, have improved and modified engine building all over the world.

Even at this late day new objects of interest appear in the various sections of the Exposition, so that he who returns to a favorite locality after a week's absence may discover still other apparatus to claim his attention and awaken his interest. Up to Tuesday night, the 23d inst., 117,000, people had visited the Exposition. Now the attendance is still greater, averaging about 7,000 daily.

Among the exhibits which have but recently appeared is an electric railway in full operation. It is laid between the main building and the annex; and though the line of rail is too short to permit of estimates of efficiency or economy being made, it deserves, by reason of the novelty of its design and the smooth working of the parts, some little attention. Readers of the SCIENTIFIC AMERICAN will remember that three types of electric railways were exhibited at the expositions at Munich, Paris, and Vienna. These were the charged-rail system, the overhead contact-motor, and the secondary battery system. All these systems are now in operation in different parts of the world, but it is very doubtful if any of them can be economically operated, save where the road is short and connects two thickly populated cities, or where the power required to run the motors is gathered from running water along the route or at the mines, where coal is cheap. On the charged-rail and overhead contact-motor systems, there is a large and sometimes ruinous loss of current while *in transitu*, and the secondary battery has not yet reached that point of perfection at which a fair amount of the power originally required to charge it may be recovered in the form of electrical energy. It should not be inferred from this that the type of railway now in operation in the International Exposition is either more economical or more efficient than the better known types just described.

It has not as yet been tried on a sufficiently large scale to determine either of these two important points.

It consists of a new method of conducting the electricity along the line for the use of the motors and also for lighting. By the method employed in transmitting the current, it has been found, it is said, that it can be economically distributed along the line of the road for purposes of illumination and even for power. In other electric lines, where electricity is transmitted to the motors from a central station, large losses of current take place, owing to the exposure of the conductors to atmospheric influences. When cold rains, sleet, and snow prevail, such lines are utterly unreliable. In the system at the Exposition there are tubes running along each track—one for the outgoing, the other for the returning current. This arrangement, it is said, protects the current from all exterior and foreign influences, while a slot cut along the bottom permits the entrance of a contact-rod from the motor, and allows of a nearly perfect contact, which, even under the most favorable conditions of weather, may not be had in the systems now in use.

The uncertainty of charged-rail currents, either on the surface or overhead, may, not inaptly, be likened unto the uncertainty of the arc light currents when first introduced into the streets of the city of New York. On wet and stormy nights these currents proved unreliable, because they were

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transmitted over unprotected conductors. Now, however, since the conductors have been properly protected, this is not the case. But to thoroughly isolate and insulate the rails of an electric railway is both costly and difficult. In the tubular system, however, since there is no pressure whatever upon the tubes, the process is both inexpensive and simple. As a result the losses from leakage and induction are, if no mistake has been made in the figures, but slight, being only 10 per cent, as against from 25 to 75 per cent in the charged-rail and overhead contact-motor systems. This saving of current would be immediately apparent in the smaller number of dynamos and decreased horse-power required to operate the line.

As said before, an arm reaches down from the motor to the tubular conductor; the crook thereon, armed with wheels or brushes, reaching underneath and making the contact. The current after leaving the motor passes to the wheels of the negative conductor, thence to the tubular conductor on the same side of the track, and returns to the dynamo. During this operation it may be intercepted by attaching wires to the negative tube, and led off to different points on either side of the road, where it should be needed to light up towns and houses, and operate small stationary motors.

The contact between the tubular conductor and the running motor is said to be so perfect that only a comparatively small amount of current is required. When the motor is at a standstill, the current passes through the switch to the negative conductor and thence to the various lighting plants along the line.

For elevated roads, or those running through the country, the conductors are attached to wooden guards placed on the ties between the rails. These can be planked over at street crossings; a slot being left for the arm to pass through.

The projectors of this system claim that, when in good running order, it will prove much cheaper than the ordinary steam railway, and that a twenty-ton electric motor on their line will do as effective work as a sixty-ton steam locomotive. For ordinary traffic, electric-motors of from six to ten tons will, they say, readily haul from three to six cars at a high rate of speed. For street cars, they think a motor of five hundred pounds, giving five horse-power, would be all that is required. On street railways, the tubes are placed in a conduit having a slot through which the contact arm receives the current.

There is an exhibit near the center of the great hall which, though remaining almost unnoticed, is, from a historical rather than from a scientific standpoint, one of the most curious and interesting groups of apparatus to be seen along any of the corridors. It is marked "Wallace Exhibit," and consists of several roughly put together electric machines that wear a weather beaten appearance, as though they had been left out in the storm. One of these machines is composed of an electro-magnet having the poles arranged vertically.

An armature, shaped like a Pacinotti ring, and made up of a series of wire coils placed at different points about a cast iron circle, revolves between the enlarged poles. The bushes on the commutator are adjusted through the agency of a worm gearing. Next to this machine comes that used at the Centennial for lighting purposes—a crude device in which an armature revolves in a field of force of antique pattern. Then there is an electroplating machine of somewhat similar construction, and, lastly, a magneto-electro "telemachon." Joined together in a field of force so as to make one magnet with multiple winding, there are twelve magnets, between the poles of which revolves an armature. Many thin plates of iron, each insulated from its neighbor, compose this armature.

For Mr. Edison, this so-called "telemachon" must have a peculiar interest. It is the first dynamo machine he ever saw, and the magnificent possibilities of such a contrivance, or rather of a further development of the principle on which it is constructed, changed the current of his thoughts, there is reason to believe, indeed he has avowed as much, into channels of scientific research where before he had been a stranger.

A brief narrative of Edison's first introduction to the dynamo machine may possibly not prove devoid of interest in connection with this historical exhibit at the Exposition. It was about six years ago that Edison and some friends, upon the invitation of Prof. Barker, of the University of Pennsylvania, visited Ansonia, Conn., to examine a power transmitting machine, as the "telemachon" was called. Being Sunday, the Wallace factory on the bank of the river was deserted, and one of the work-rooms was used for the exhibition. Electricity was generated by the rubbing together of two wire brushes, and six or eight large arc-lights were kept aglow. The amount of power recovered at the end of the second machine of that applied to the first was variously estimated, but it was sufficient to demonstrate to Edison the feasibility of the project of collecting the power of running streams and transmitting it to a distance in the form of electric energy. The operation of the machine filled Edison with delight, the genuine, unalloyed delight of the child when first in possession of a new and ingenious toy. It is alleged that Edison was never known to be enthusiastic, but the writer, who was one of the party that day, can bear witness that this allegation is unfounded. There is reason to believe, however, that the thoughts of the wizard were straying far beyond the walls of the Ansonia factory. In all likelihood, it was more than the mere working of this crude machine that filled his mind. It was its future possibilities—the development of the principles and laws upon which it was constructed.

Some weeks later this "telemachon" or a similar one was sent out to Menlo Park, and thereafter his attention was directed almost wholly toward improving the dynamo, and in discovering a means whereby its current could be economically subdivided.

The Edison dynamo and the mechanism of the incandescence light are the results of his experiments and investigations in this direction.

An electric cigar lighter is shown at the Exposition, which has the merit of not costing anything for current when not in use. It is not designed for use with a primary battery, and very properly, because this would render it at once expensive and troublesome.

It is made to hang between two incandescence lamps of the sixteen candle power type, and diverts a sufficient quantity of the current to feed itself, while at the same time not taking enough to appreciably lessen the intensity of either. As may be inferred, this cigar lighter is designed for use only where there is already an electric installation.

It consists of a circuit breaking device somewhat similar to that used in the telephone, the weight when it is hung up breaking the connection. The weight of this cigar lighter is sufficient to keep the connection broken at all times when not in use, and hence, as said before, there is no loss of current. The act of raising the handle to light a cigar switches in the current. This acts upon several fine strips of platinum set in a plug of cement.

These platinum strips are placed in series with the incandescence lamps overhead. The handle in which they are set hangs by a flexible cord, and, so far as appearance goes, does not differ from that usually employed with gas.

If only a tithe of the instruments for indicating distant temperatures, relative humidity, specific gravity, height of water, etc., shown at the Exposition ever come into general use, the average citizen may, not unreasonably, be expected to become something of a scientist. He may keep himself so exactly informed of the conditions of air and water afar and anear, and the strength and direction of prevailing winds, as to look upon weather reports as upon old almanacs and the bureau whence they come as a purveyor of obsolete intelligence. Some of these instruments on exhibition are good but not new, while many have the commendable quality of novelty without the necessary adjunct of efficiency. With a multiplicity of indices over his head, indicating the temperatures of his dwelling, his office, and his country-seat, the height and temperature of his ponds and wells and the boilers in his factory, the average man is likely to fall into grave errors. The sudden fall in the temperature of his cellar, as indicated in the index over his head, might throw him into a towering rage, under the impression that the cook had let the furnace fire go out, whereas it is only a burglar climbing in through the cellar window; and the delight experienced in seeing by his office index that the spirit barrel in his wine closet has suffered no diminution would be turned to bitterness in discovering, upon a personal examination, that this height had been maintained by his man, by pouring in water to make up for the liquor that he had abstracted.

The telethermometer shown at the Exposition may be relied upon, as its name implies, to indicate temperature at distant points. In breweries, malt houses, distilleries, oil, sugar, and other refineries, refrigerators and the like, it will prove of great service; but that it may be relied upon to indicate the presence of icebergs at sea, as its projectors declare, there is very excellent reason to doubt. It is likely, at sea, to prove about as valuable as the ordinary thermometer, and not more so. The fact is, as masters of ships have frequently testified, but little confidence can be placed upon any type of thermometer so far as indicating the approach of ice is concerned. Sailing gradually from the cold wall of the Gulf Stream into its warmer waters, the thermometer will invariably rise, though large masses of ice are ahead, because the warm influences of the Stream are stronger than the cold influences of the ice. Given a dead calm or a head wind, that is to say, a wind blowing against the course taken by the ship, and the thermometer will indicate the presence of icebergs ahead, because the wind having come from their direction has felt their influence.

But it has often been demonstrated that, where a fair wind prevails—a wind blowing in the same direction the ship is going—the fall of the mercurial column, if it takes place at all, will be so insignificant as to prove no warning whatever. Hence it is that masters of ships place little reliance upon thermometers for indicating the approach of ice; and as the telethermometer can only indicate distant temperatures when the distant point is connected by wire, it would prove, as said before, no more reliable aboard ship than any other good thermometer. The telebarometer indicates and records electrically barometric pressures at a distance, and like the telethermometer is valuable in all continuous meteorological observations. The telemanometer indicates and records automatically and continuously the pressure in a boiler. The telehydrobarometer indicates and records the heights of water in reservoirs, storage ponds, rivers, lakes, dams, and tanks.

A valuable use for this instrument is that of recording at one point the heights of water in various sections of canals, and recording at one point simultaneous tidal observations taken at different parts of a river or bay. In other words, it might readily be made to take the place of the self-registering tide-gauge, which has been used for years to keep a record of the tides of various localities. It is worked automatically by clock work; a pencil being made to draw a curve upon parchment, the high points indicating high water, the horizontal lines slack water, and the low points low water. The telehydrobarometer, despite its name, is of simple construction, and does its work in much the same manner as the self-registering tide-gauge, save that, as said before, it can send its readings, electrically, to a central station.

The official tests of the various exhibits, from which so much is expected, have little more than begun, and it is not easy to understand at the present rate of progression how even a small portion of that which should not be permitted to depart without critical examination can be tested before the Exposition closes its doors. Of course there is much that does not require very elaborate tests, and still more the projectors of which are by no means enthusiastic to have compared with similar apparatus. But it was understood, indeed proclaimed, at the start that everything would be critically examined, and an official report made thereon by the Committee; a certified copy of which would be given to the proprietors of the apparatus.

Many persons are looking forward with not a little curiosity for the official reports to be made of the several apparatus, because, since the committee having the matter in charge are in no wise interested, save scientifically, in what they are to pass upon, and are abundantly able to get at the real measurements, cold facts are likely to appear in a somewhat phenomenal profusion, and that is likely to be learned regarding the efficiency of certain apparatus of which the projectors have not, up to the present, given even a hint.

Rapid Progress in Electric Science.

The Philadelphia *Ledger* makes the following note of progress in the application of electricity: "Only twelve years ago Professor Tyndall gave his course of memorable lectures in Horticultural Hall. He had with him as a part of his apparatus an arc light. The lamp was regulated by clockwork, and cost probably ten times as much as the lamps made to-day. It was imperfect in every way, the light being very unsteady, and several times got out of order at critical moments. The current was supplied from a voltaic battery, at a cost that precluded its use for any but lecturing purposes. The battery, besides being costly and troublesome, required the constant work of an attendant for a day or two to 'set up,' and it also was very apt to get out of order. Dynamo machines were not unknown at that time, but they too were costly, and for lecturing purposes the battery was considered best. Looking at the display of lamps in the exhibition, and the great variety and number of dynamo machines, it seems almost incredible that it is only twelve years since such a man as Professor Tyndall was well pleased, rather than otherwise, to be able to exhibit his poorly regulated clockwork lamp, run by some hundreds of cells in a voltaic battery!"

The First Telegraphic Instrument.

At the Electrical Exhibition a large display of models from the Patent Office, under the charge of Mr. J. M. Churchill, are exhibited. Among the two hundred and fifty pieces is the original Morse telegraphic apparatus, patented April 11, 1846. The transmitter is mounted on a pine block, and is very crude. The armatures are wound with very coarse and poorly insulated wire, and the sounder consists of an ordinary piece of stick, which strikes against a piece of iron. The clockwork which operates the cylinder, about which the perforated paper was wrapped, is of a more improved pattern. On the card attached to the exhibit is the following, said to be an effusion of a clerk at the Washington office:

"The steed called Lightning," says the Fates,
Was tamed in the United States.
'Twas Franklin's hand that caught the horse
That was harnessed by Professor Morse."

A New Carbon Battery.

A new voltaic battery has been brought out by M. Tommasi and M. Radiguet, in which peroxide of lead surrounds the carbon plate as it lies on the bottom of the cell. The other plate is also of carbon, covered with fragments of retort carbon platinized. The two plates are placed one above the other, but separated by a sheet of parchment paper which divides the containing vessel into two compartments. A saturated solution of chloride of sodium, or common salt, is filled into both compartments until the upper carbon fragments are partly immersed in it. The electromotive force is 0·6 volt. The negative pole is that carbon plate which is not in contact with the peroxide of lead. If other saline solutions, such as sulphate of ammonia, sulphate of soda, chlorhydrate of ammonia, or even dilute sulphuric acid, be used instead of the solution of salt, the electromotive force does not sensibly vary.

Isaac Newton.

Isaac Newton, chief engineer of the Croton Aqueduct Department, New York, committed suicide Sept. 25, in a fit of temporary insanity, said to have been caused by overwork. He was in his forty-seventh year, and a brother of the late Dr. Henry Newton, the geologist. He studied mechanical engineering in the Delamater Iron Works, made a survey of the shoals of the upper Hudson, was engaged in the construction of the orignal Monitor, and was an engineer on board during her combat with the Merrimac. He was a member of the American Society of Civil Engineers and the Society of Mechanical Engineers.

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THE METROPOLITAN RAILWAY OF PARIS.

The project for a metropolitan railway submitted by the State for the examination of the General Council of Bridges and Roadways, as well as to that of the Municipal Council of Paris, has been definitely adopted by the Government, and declared of general interest. It will probably be the object of a concession to a special company, which will undertake its construction and operation without requiring either any subvention or guarantee of interest.

According to the proposed scheme, the railway will be subterranean for the greater part of its length. Starting from Puteaux, the passenger will pass under Grande Arme Avenue, the external boulevards, Rome Street, Boulevard Hausmann, and the great boulevards, and will not emerge into the open air until he reaches the Bastille. Such is the principal route.

The city will gratuitously concede the subsoil of the wide streets that we have just named, and it is owing to this that the cost per kilometer will be reduced to the expense of constructing the long tunnel and the two tracks.

The passenger will descend to a depth of about 8 meters, and will travel beneath the earth, just as if he were in the Saint Gothard Tunnel.

Is it possible to give the public of Paris, which is essentially artistic, completer satisfaction? Can it be offered easier and more rapid travel than it has at present? On another hand, can it be shown at the same time in these multiple routes the different panoramas of the great metropolis? Yes, most certainly, provided that more is spent, and, consequently, that the company is subsidized or guaranteed a minimum of interest.

The entire question of elevated or of an underground line is reduced to this question of cost. It is well said, it is true, that underground traveling is performed at London; but it is not always added, when this question is being discussed, that the London company is making enormous sacrifices every year to bring to the light and air every part of its line that it is capable of getting out of the darkness and sulphureted atmosphere that fill this long tube.

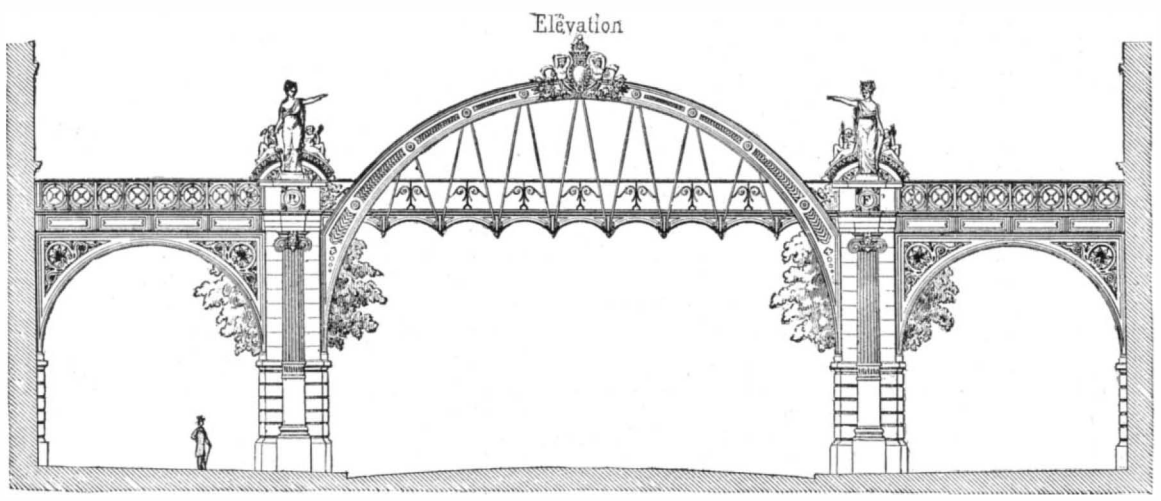
And then, should we not offset the example of London by that of New York, Berlin, and Vienna, where traveling is everywhere done above the surface? Should we copy the old English city railways, or should we do like the American and our neighbors across the Rhine? Such is the question, and the answer to it does not appear doubtful.

However this may be now, or a little later on, when the subterranean will be doubled by an aerial one, there is one side to the aerial problem which has served as a theme for partisans of the underground project, and that is the one relating to traversing the boulevard. It has been contended that this aerial road is impracticable because it will injure the aspect of that thoroughfare.

It goes without saying that it scarcely seems possible to construct an elevated railway longitudinally to this so frequented avenue, which, although it formerly appeared to us so spacious, has become insufficient because of the ever increasing travel therein.

Moreover, it will not do to hide the Madeleine and the Opera House, or the gates Saint Denis and Saint Martin. It is necessary, then, to cut this principal artery perpendicularly to its axis, either by new streets opened for the peculiar needs of the Metropolitan, or by reaching it through houses whose interior, being of less value than the parts in front, may be traversed without necessitating so great expenses.

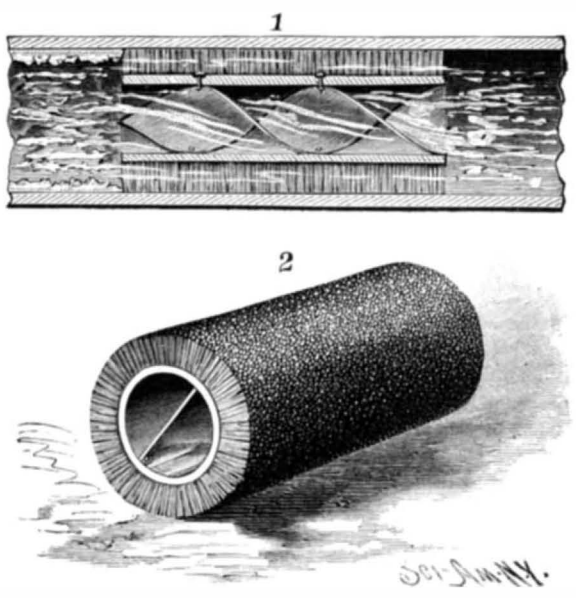
It was in order to try one of the thousand possible solutions of such a mode of crossing the avenue that we some time ago took up our pencil and made the sketch which is herewith reproduced.—*Le Genie Civil.*



THE METROPOLITAN ELEVATED RAILWAY, PARIS.

PARAFFINE BRUSH.

Crude petroleum in its passage through pipes deposits paraffine on the surface of the pipe, thereby obstructing and sometimes stopping the flow. In very short pipes it is a simple matter to remove the deposit by means of rods or scrapers, but it is impracticable to clean out long lines by ordinary methods. The object of an invention lately



THOMAS' PARAFFIN BRUSH.

patented by Mr. Henry C. Thomas, of Rock View, N. Y., is to provide means of clearing away the paraffine by mechanical agency without the use of solvents or heat. The clearing device is made in the form of a hollow cylinder, to which is attached a series of wire cutters projecting radially from the exterior. One or more blades, made of metal in spiral form, are arranged within the cylinder, as shown in the engraving. The cylinder is so proportioned that its length is about four times its diameter.

The cleaning device is inserted in the pipe, where it is pushed forward by the flowing liquid, the projecting wires loosening any paraffine that may slightly adhere to the walls of the pipe. Should the wires come in contact with a deposit of sufficient thickness to check the motion of the brush or to stop it, the force of the current will then act upon the spiral blade, causing the device to rotate and cut away the obstruction.

OUR Government has now $170,000,000, or 600 freight car loads, of silver dollars piled up in its treasury vaults, and is still manufacturing at the rate of two millions a month.

Milk.

The following synopsis, by the *Sanitarian*, of a paper by Dr. Dougall, of Glasgow, detailing experiments conducted with a view to discovering the absorptive power of milk on various volatile substances, will be of interest:

Dr. Dougall inclosed in a jar a portion of certain substances giving off emanations, together with a uniform quantity of milk, for a period of eight hours. At the end of that time a sample of milk was drawn by means of a pipette from the lowest stratum of the vessel exposed in the jar; and we find that the following were the results of his experiments:

	Smell in milk.
1. Coal gas	distinct.
2. Paraffine oil	strong.
3. Turpentine	very strong.
4. Onions	very strong.
5. Tobacco smoke	very strong.
6. Ammonia	moderate.
7. Musk	faint.
8. Asafetida	distinct.
9. Stale urine	faint.
10. Creosote	strong.
11. Cheese (stale)	distinct.
12. Chloroform	moderate.
13. Putrid fish	very bad.
14. Camphor	moderate.
15. Decayed cabbage	distinct.

It thus became obvious that the milk had absorbed the emanations of all the substances to which it had been exposed, and it further transpired that all the specimens examined retained their distinctive odors for as long as fourteen hours after their removal from the glass jar in which they had been exposed.

Cream, according to Dr. Dougall, may be regarded as acting in much the same manner as milk; indeed, although it contains less water than milk, yet it has special qualities of its own, which may perhaps make it even more liable to retain offensive and dangerous emanations than the parent fluid itself. Abundant evidence has, however, been given to show that far more care is needed in connection with the storage of milk than has heretofore been regarded as necessary, and this especially where milk or cream is kept in apartments or wards occupied by sick persons. If the emanations to which the milk is exposed are of a diseased and dangerous quality, it is all but impossible that the sample can remain free from offensive and dangerous properties; and it should become an invariable rule to keep as little milk as possible in sick rooms, and never to allow a supply which has been thus exposed to unwholesome emanations to be used for food.

Under these circumstances it has been lately held desirable to boil all milk which is open to suspicion before using it. In the course of several epidemics in which milk has acted as the vehicle of infection, it has been noticed that persons who had only consumed it after it had been boiled escaped all ill results, whereas other members of the same family or community, who had not taken that precaution, had been attacked with disease.

The Men Who are Promoted.

The *Manufacturers' Gazette*, in a recent editorial, made the following statements, regarding young men and their advancement, which others than the class to whom it is addressed will do well to heed:

"The young men who receive promotion are the men who do not drink on the sly. They are not the men who are always at the front whenever there is any strike, nor are they the men who watch for the clock to strike twelve, and leave their picks hanging in the air. They are not the men who growl if they are required to attend to some duty a few minutes after the whistle has sounded. They are the men usually who pay the closest attention to the details of their business, who act as if they were trying to work for their employer's interest instead of to beat him at every crook and turn. They are the men who give the closest attention to every practical detail, and who look continually to see whether they can do any better or not. This class of men are never out of a job. They are scarce. They never strike, they never loaf, and they do not ask for their pay two or three weeks before pay day."

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THE EDIBLE CRAB.

The life history of the crab is extremely interesting. The strange little animal that escapes from the egg resembles in no respect the parent crab. Its form is lengthened, ending in a forked tail; on the back is a long spine curving backward, and on each side a short spine directed outward. The eyes are large but not projecting, and the head is armed with a mosquito-like rostrum. This first stage of the crab is called zoea. After remaining for a certain length of time in the zoea form, it comes forth from its infant skin an entirely changed animal. Here the eyes are very large and projecting, the body squarish, without the long spine seen in the first stage; it has eight perfect legs and two claws; the "tail" has become short, and turned under; and yet it has no resemblance to the mature crab. This second form is called the megalops or great-eyed stage. When it again changes its skin, the body assumes a much broader shape; a distinct spine appears on each side, and the tail-like process is doubled up under the body. When its skin again becomes too tight for it, it at length comes forth a small but perfectly formed crab, *Callinectes hastatus*.

The crab is obliged to moult or cast off its shell many times during its life. This moulting appears to be an unpleasant ordeal to pass, for they often die during the act. When we see that they are not only obliged to escape from the carapax or shell, but also from the hard covering of their legs, delicate mouth parts, and even gullet—turning themselves inside out, as it were—it is not surprising that they perish during the ordeal. The crab crawls up into some secluded nook or cove in shallow water to moult, out of the way of its hard-shelled relatives, for the helpless, newly moulted, or "soft shell crab," if found, is devoured by them, as well as by several species of fishes.

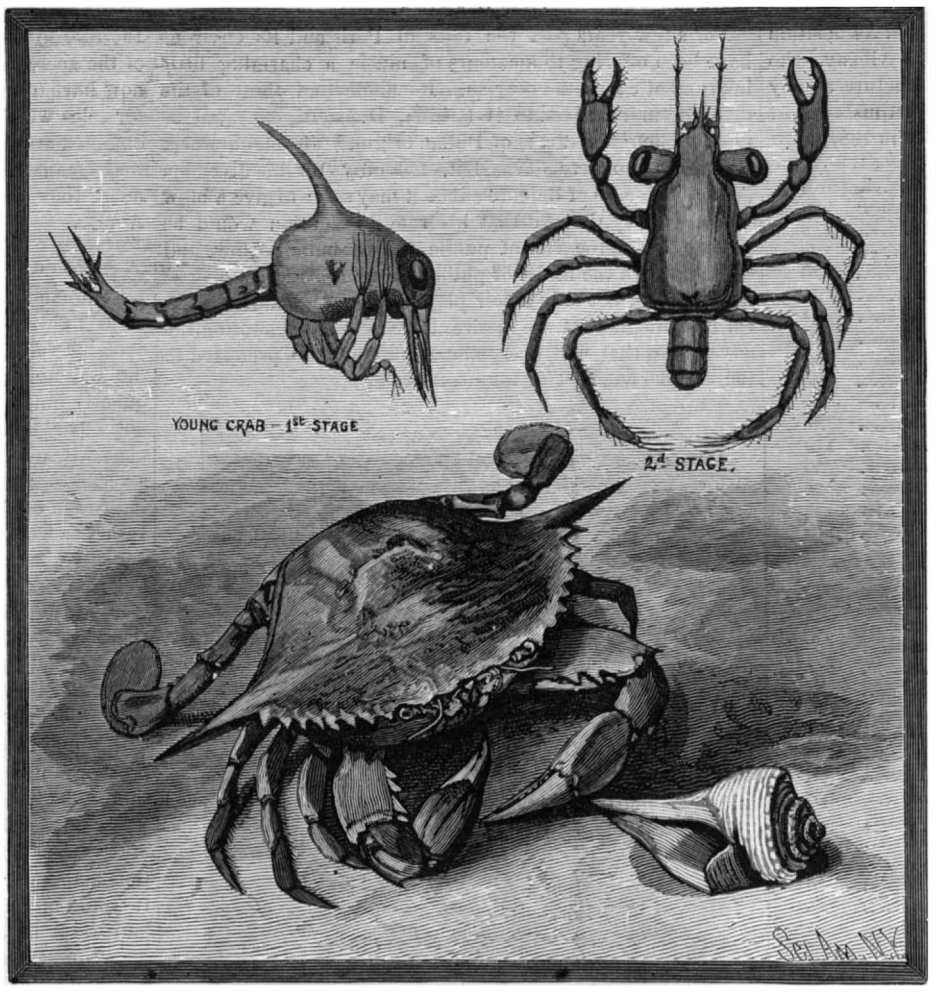
Fortunately for the crab, the soft covering hardens rapidly, and in a few hours it has a new and strong armor, and it then goes fearlessly out into the deeper water among the eel grass.

Crab fishing is an amusing but not always exciting sport. You simply row up into some shallow cove or bay of the seacoast, which has a muddy and grassy bottom, cast anchor, tie a good sized piece of meat on a strong line, lower it to the bottom, and wait for a bite. When you perceive a tug at your line, pull it up gently until the crab is visible; you must not attempt to lift it out of the water by means of the line, for then the crab will quit its hold and escape, but with one hand quietly but adroitly get the dip net under it, and with a dexterous sweep land it in the boat. Frequently two or three crabs are caught on the line at once.

Should you chance to go crabbing with a party of ladies, be extremely careful that they do not overturn the basket of lively crabs about their feet, for if this happens you will have your light skiff almost or entirely upset by the ladies jumping up and standing upon the seats, and you will get your fingers pinched, perhaps until the blood comes, as you recklessly endeavor to catch the crabs as they wildly scamper about the bottom of the boat. I have learned this from experience.

The edible crab of our coast can always be known by two long lateral spines of the carapax. The claws are blue above and whitish beneath, and the carapax above is of a dull olive or bluish color. It is called the "blue crab" by the fishermen of the New England coast.

C. FEW SEISS.



THE EDIBLE CRAB.

SADDLE MEN.

In Nepaul, India, there is a class of natives who serve as "saddle men," and take the place of saddle horses. Strapped around the waist and fitting into the curve of the back is a padded ledge. It is supported vertically by shoulder straps.

The rider rests on the ledge, in the position shown in the engraving, which is from the *Graphic*, and represents the Duke of Portland, and the Earl De Grey, going on a hunting excursion. Ladies of rank in this part of India are carried on "saddle women," in the same style.

SADDLE MEN.

Rain and Snow.

A paper giving results of experiments with rain gauges differently located, and of experiments as to the ratio of depth of snow to the depth of same when melted, by Edmund B. Weston, was lately read before the Amer. Soc. of Civil Engineers. It was found that in a number of experiments extending over considerable periods of time a gauge 14 ft. 8 in. above the ground collected 9 per cent less water than one 8 in. above the ground; that a gauge 22 ft. above the ground collected 10½ per cent less water than one 8 in. above the ground, and that a gauge 3¼ ft above the ground collected 6·7 per cent less water than one 3 in. above the ground.

The average result of 53 experiments at one point was that the depth of snow was 6·25 times the depth of the same when melted, and the average result of the same number of experiments at another point gave 6·64 times the melted depth.

Wood Flour.

A letter from the Catskills to the New York *Sun* says: The chief industry up here is producing wood flour, a kind of cousin to wood pulp. It was first manufactured in the Catskills about nine years ago, and now over twenty mills are in full blast. The process is exceedingly simple. Any soft wood tree—poplar is the favorite—is felled and drawn to the mill. The bark and boughs are removed, and the trunk put in a machine which is nothing but a lead pencil sharpener on a large scale, with four or more knife edges instead of one. On starting the machine the pencil sharpener revolves with great swiftness, and in a few minutes converts the log into a hundred miles of fine, clean shavings. These are ground and bolted exactly as in a flour mill. The product is a soft, fine, yellowishly white flour, similar in appearance to a very well ground corn meal. It possesses a slight woody smell, and is almost tasteless. It is put up in large bags, and then is dispatched, unmarked, to the buyers.

I tried to find out who purchased the article, but with no success. The wood miller was not very communicative. "It makes," he said, "well, I don't know how much exactly. One log may give five bags, or it may give ten. It sells, well, that is, pretty tolerable. I reckon I clear about $8 or $9 a day out of it—perhaps more. I never figured it up. What's it good for? Good many things. It's used to stiffen paper, but if you put in too much the paper gets brittle. Paper stock is much dearer than poplar flour, and that's why they put it in. If you mix the flour with linseed gum and 'biled' oil, you may get a kind of oil cloth. Some folks mix it with meal to give to pigs and other animals. I guess it's good, but I never give it to my hogs, and even those fellows give it to some other fellow's critters, and not their own. Yes, I heard that some bad contractors mixed it with meal for army and Indian supplies, but I don't take much stock in the story, because they could buy sour meal as cheap as poplar flour. It wouldn't pay to mill pine, cedar, or hemlock; they are worth too much as timber. But any wood that isn't used that way can be milled into flour. I use poplar almost altogether, but when I run short of logs I grind up buttonball, birch, elm, or willow."

The farmers dislike the new industry, as it promises to play havoc with the forests, which are both an attraction to the border and a protection to agriculture. The tanneries years ago used up all the oak and hemlock; the lumbermen have stripped the country practically of pine, cedar, and walnut; the chair factories are consuming the hickory and maple; now the wood flour mill promises to grind up what remaining trees there may be.

Opening of Great Grain Regions.

Russia has resolved to develop her system of railway communication on an enormous scale, and for this purpose has just contracted a loan of $75,000,000, to be expended during the next few years. India has already built lines of railway penetrating the furthest provinces. Australia has also made long strides in the same direction. Next in order is the Argentine Confederation, in South America, which is building four additional trunk lines of railroad at a cost of $28,000,000, to connect Buenos Ayres, her principal seaport, with the vast granaries opening up in the pampas of the interior. In every case the ultimate purpose is to overcome all impediments in reaching the central grain markets of Europe. And, in spite of all this, says the *British Trade Journal*, American grain speculators continue their efforts to artificially maintain the price of wheat, as though there were a great deficiency in the supply of the world, and the nations would eventually have to come to them begging the privilege of being allowed to purchase some of their surplus.

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The Cost of Making Stoves.

At the late semi-annual meeting of the National Association of Stove Manufacturers, Mr. John T. Perry, of Albany, who probably knows as much about stove manufacture as any one, made the following statement of the estimated cost per ton of making stoves in the United States in 1884:

Foundry Cost.	
Iron	$20.00
Mounting material (nickel panels, rails, etc., not included)	8.00
Fuel for all purposes	2.75
Moulding sand and clay	.40
Facing	.25
Patterns, flasks, and lumber material	.75
Shipping material	.10
Freight and expressage	1.25
Machinery and tools	1.75
Repairs	.40
Gas and oil	.20
Stationery and books	.10
Rent	1.00
Insurance	.40
Taxes	.25
Miscellaneous and pilferings	.40
Castings broken and discarded that have been paid for	1.00
Total	$39.00
Labor.	
Moulding	$24.00
Mounting	8.00
Pattern making	1.45
Pattern fitting and repairs	1.50
Pattern moulding	.25
Carpenters	1.25
Cupola men, breaking iron, etc	.75
Cleaning and filing	2.00
Engineer	.30
Shipping	1.05
General labor	1.00
Watchman	.20
Foreman, moulding, and mounting	.50
Clerk	.50
Trucking	.75
Miscellaneous and pilferings	.50
Total	$45.00
Selling Expenses.	
Allowances, various kinds	$1.25
Attorney's fees	.25
Advertising, circulars, etc	1.75
Bad debts	2.00
Clerks	1.60
Freight on stoves delivered	1.00
Gas and oil	.10
Insurance	.20
Interest	2.00
Discount for cash	2.50
Miscellaneous and pilferings	.50
Postage stamps and telegrams	1.00
Rent	1.00
Stationery	.15
Traveler's wages	2.75
Traveler's expenses and general traveling	3.25
Taxes	.20
President and Secretary	1.50
Total	$23.00
Grand total	$107.00

In connection with the above, Mr. Perry said: "Gentlemen, everything in this world is imperfect, and so is this statement. Many of the items, I know, and you well know, are too low; for example, $5.20 per ton, or $15,600 for the year, for patterns and flasks, on a product of 3,000 tons, should be put down at twice that sum. Some items may be too high, and in many cases should be excluded altogether from the list, yet I believe the average cost on the basis named, taking one year with another, will reach $107, and generally more than that sum."

Properties of Quicksilver.

One of the most curious properties of quicksilver is its capability of dissolving or of forming amalgams with other metals. A sheet of gold foil, dropped into quicksilver, disappears almost as quickly as a snow flake when it drops into water. It has the power of separating or of readily dissolving those refractory metals which are not acted upon by our most powerful acids. The gold and silver miners pour it into their machines holding the gold bearing quartz; and, although no human eye can detect a trace of the precious substance, so fine are the particles, yet the liquid metal will hunt them out, and incorporates it into its mass. By subsequent distillation it yields it into the hands of the miners, in a state of virgin purity. Several years ago, while lecturing before a class of ladies on chemistry, we had occasion to purify some quicksilver by forcing it through chamois leather. The scrap remained on the table after the lecture, and an old lady, thinking it would be very nice to wrap her gold spectacles in, accordingly appropriated it to that purpose. The next morning she came to us in great alarm, stating that the gold had mysteriously disappeared, and nothing was left in the parcel but the glasses. Sure enough, the metal remaining in the pores of the leather had amalgamated with the gold, and entirely destroyed the spectacles. It was a mystery which we never could explain to her satisfaction.—*Fireside Science.*

PUSCHER, in the *Chemiker Zeitung*, states that the following cement resists kerosene, and is useful for cementing the brass collars to glass lamps. One part of caustic soda, three parts of resin, and five parts of water are boiled together; the resin soap thus produced is mixed and well kneaded with half its weight of plaster of Paris. It hardens in about three-quarters of an hour. If zinc white or dry white lead is used, it hardens more slowly

THE OCARINA.

For a few years past the fairs of Paris and its environs have been offering to amateurs of music a charming little instrument called the ocarina. Its name and those of the manufacturers affixed to it (Girola, Donizetti, etc.) tell us plainly enough that it is of Italian origin. The mountaineer who is said to have devised it, not only for his diversion but also a means of defense (since it may serve to give a blow with), scarcely thought that his rough invention would be patented, have the run of public places, enter parlors, and even figure in the midst of philharmonic societies.

It is, then, not only a new plaything, but a genuine musical instrument that we desire to extol in enumerating the advantages that will everywhere cause it to be preferred to the wooden flageolet or the tin flute.

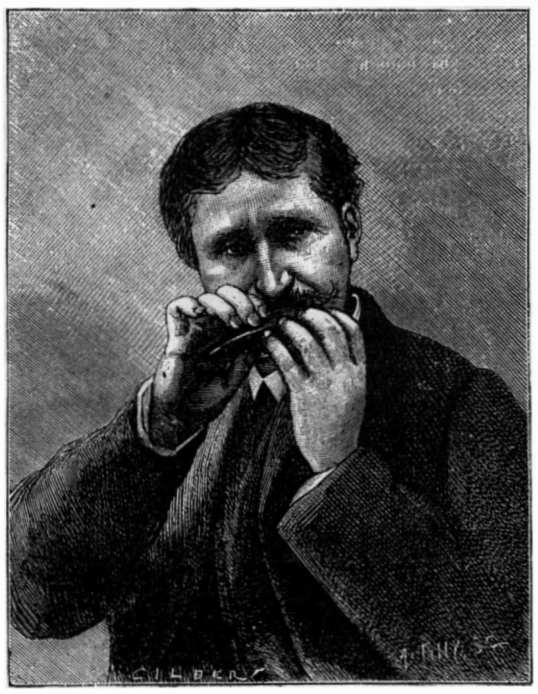

Fig. 1.—MODE OF USING THE OCARINA.

At its debut the ocarina was merely a little glazed baked clay, having the form of a black radish externally, but hollow internally, provided at the side with a mouth piece, and having nine or ten little apertures along it in place of keys (Fig. 2, No. I.). Its sonorous power ranged from *ut* natural to *fa* of the octave, passing through all the notes of the chromatic scale. It remained as primitive as this for a long time, and more than one amateur was enabled to draw from it lullabies and other music of the kind; but the programme that could then be got from its circumscribed range had its limit there.

A certain band of minstrels once passed through our northern towns, and their presence there has not been forgotten. This little troop had put aside the harp, the mandolin, and the violin, in order to give delightful serenades with well tuned ocarinas. It was original and delightful. But although in harmony, their scores, since they varied only from the melody to the third of the same octave, did not have the same interest as if they had been rendered from a grave to a sharp tone; and this gave rise to the idea of manufacturing the instrument in different sizes. So there soon appeared the soprano ocarina, which was smaller than an ordinary carrot and clearer than a small flute, and the double bass ocarina, larger than a pumpkin and graver than the alto. The principle remained the same. But the

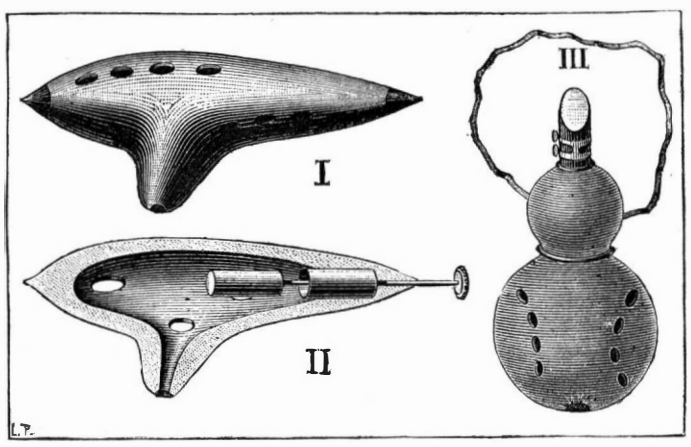

Fig. 2.—THE OCARINA IN PERSPECTIVE AND SECTION.

ocarina still had one drawback, and that was that it could not accord with the piano or the flute, from which it sometimes differed by one note. To obviate this, the instrument was provided with a piston, which, when drawn out or pushed in, raised or lowered the sounds by one note (Fig. 2, No. II.).

Finally, as a last improvement, a series of keys was added, symmetrical with the row of holes on the left side, thus giving a second complete scale.

The idea embodied in this simple instrument has caused us to make an experiment that has proved quite successful. We took a pilgrim's gourd, and first made some minute apertures in it, arranged something like those of the ocarina. For a mouth piece we affixed to it with wax an old one from a clarinet that was provided with a reed. In order to obtain notes—perfect gamuts—we enlarged each of the apertures with a knife until it gave the tone, and we now have a sordine that in no wise cedes to the hautboy for solos which are not very complicated. The sounds thus obtained are preferable to those given by the ocarina, since they emanate from wood, and not from clay. The instrument thus modified is shown in Fig. 2, No. III.—*La Nature.*

Need of Improvements in Marine Signals.

Commander Gorringe has written a letter in regard to ships' lights, called forth by the Tallapoosa disaster, which contains valuable suggestions. He shows that not only are the red and green side lights now carried by vessels frequently mistaken one for another, even by men who are not color blind, but that the position in which they are placed is such that in certain circumstances it is possible for a vessel to alter her course sixty degrees without giving any indication of the alteration by the appearance of her lights. In other words, the present system of lights is miserably defective, as is shown by the fact that it has failed in hundreds of instances to prevent collisions at sea. In the place of the red and green side lights it is proposed that every vessel shall carry four range lights. Two of these should be placed forward, and two aft. Of the forward lights one should be a white light and the other a red light, the latter to be placed somewhat higher than the other and some distance aft of it. The after lights should be arranged in a similar manner, except that the red light should be lower than the white light. This arrangement would render it possible to ascertain from the appearance of a vessel's lights the course steered by her, and the direction and amount of the slightest deviation from that course. It would also enable a steamer to avoid running directly into the stern of a slower vessel where both are steering the same course, and no one on board the slower vessel has the forethought or opportunity to a display a "flare." One objection to this plan is the fact that most persons who are to any extent color blind are unable to see the red ray. Were a blue light to be substituted for the red light, and were range lights to take the place of side lights, nothing except the grossest stupidity could bring about a collision between two vessels on a clear night.

Ear Diseases.

Dr. K. Buskner in a very elaborate paper in *Archiv fur Ohrenheilkunde* gives the results of his clinical observations and those of twenty other aural surgeons. From these he finds that on an average out of every three individuals in middle life one does not hear so well in one ear as in the other, while from an examination of five thousand nine hundred and five school children twenty-three per cent presented objective pathological symptoms of ear disease, and thirty-two per cent a diminution of hearing power. The following general conclusions are drawn from this immense mass of detail:

1. The most frequent causes of diseases of the ears would seem to be attacks of cold, affections of the nasal and pharyngeal cavities, and acute infectious diseases.
2. The liability to disease, of the ear increases from birth to the fortieth year, and decreases from thence to old age.
3. Men are more subject to affections of the ear than women, as three to two.
4. The external ear is affected in twenty-five per cent, the middle ear in sixty-seven per cent, and the inner ear in eight per cent of the total number of diseases of the ear.
5. The left ear is more frequently affected than the right, as five to four.
6. The acute affections of the middle ear occur less frequently in the summer and autumn than in spring and winter.
7. Of the total number of cases of ear disease in the outpatient cliniques about fifty-three per cent are cured, about thirty per cent are improved, seven per cent. are unimproved and three-tenths of one per cent terminate fatally.

Safe Lubricating Oils.

The standard of a perfectly safe lubricating oil, free from spontaneous combustion, which was established by the experiments of the Boston Manufacturers' Mutual Fire Insurance Company, is as follows: A mineral or "paraffine" oil, so called, bearing:

1st. A fire test of 300° or more.

2d. An evaporation of 5 per cent or less in twelve hours, at a constant heat of 140°.

3d. The greatest degree of fluidity consistent with keeping the oil upon the bearing.

There are now few or no oils offered to the members of the mutual companies by oil manufacturers of repute which do not meet this standard; but there are some of the members who prefer an admixture of fine animal oil to give more body to the lubricant.

To this end high-grade neatsfoot oil is sometimes mixed with mineral oil, and so long as the oils remain thoroughly mixed as much as 25 per cent of neatsfoot oil may be safely used. But five recent cases of spontaneous combustion (fortunately all extinguished without loss) have called attention to a tendency in these oils to separate, so that the neatsfoot oil has apparently been applied nearly free from mineral oil, and in such cases fire has ensued. Great care should therefore be taken that mixed oils are kept in safe condition by frequent agitation or stirring.

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Anomalies of the Sewing Machine Business.

In an editorial in a recent issue of the SCIENTIFIC AMERICAN, under the above title, the following paragraphs appeared, to which we have received a reply from a lady subscriber from Michigan.

"A psychological fact, possibly new, which has come to light in this sewing machine business is that a woman will rather pay $50 for a machine in monthly installments of five dollars than $25 outright, although able to do so.

"The curious processes of reasoning by which the feminine mind is led to regard the lapse of time as a cheapener and a hundred per cent interest as of no consequence, have not yet, we believe, been discovered."

Our correspondent replies: "She does it from policy, for if she says, 'Husband, I wish $25 to buy a sewing machine with,' she expects a shrug of the shoulders, and is unable to obtain the money; but if she says, 'I can buy a sewing machine, and pay for it in monthly installments, only $5 each month,' perhaps she can get the coveted machine. A psychological fact, but is it masculine or feminine?"

Protection and Free Trade To-day.

An interesting paper under the above title was lately read before the Arkwright Club, Boston, Mass., by Robert P. Potter. The paper in full has been published by Jas. R. Osgood & Co., Boston. It is full of valuable facts. We make a few extracts:

The abandonment of protection will in no way help the farmer, as the free-traders claim. It will stop immigration, and hence lessen the ever-increasing demand for food at home, while it will leave him in a much worse position than he now is in, in the matter of Indian and Russian competition. In the words of Judge Kelley, of Pennsylvania:

"The primary want of the American farmer is a quick, remunerative home market. When our mills, forges, furnaces, and factories were busy, and our operatives were well paid, we consumed nine-tenths of all the cereals we could grow; but with idleness prevailing in industrial centers, with the reduction of wages and the power to consume, and with great branches of industry expelled from the country, we cannot look to an increase in the home demand or the maintenance of past prices."

The American farmer must not forget that, besides the direct benefit he receives from the protective tariff in the duty on wool and all agricultural products, and the indirect benefits in the increase, as I have shown, in the value of his land and the price of its product, and the continued cheapening of his manufactured goods, there is yet another advantage in this system too often overlooked by our farmers. The protective tariff prevents direct taxation. Abolish your custom houses, as the more fanatical free-trader proposes, and annually over $200,000,000 must be raised by direct taxation.

The farmers of Michigan have been looking into this question of direct taxation, and the curious results they have reached will be of interest to farmers throughout the country. The statistician has discovered that the despised custom houses produced, in 1882, $213,000,000; that this amount, distributed among the several States of the Union, according to population, as the free-traders propose, would add the snug sum of $6,956,982 to the annual tax roll of Michigan, an amount equivalent to 8½ mills on the dollar. To distribute this tax on the assessed returns would in some cases double, and in others treble, the present State and county taxes. For example, the State and county tax of Wayne County, Michigan, was $367,578 in 1880, and the United States tax, by direct taxation, would be $1,116,700—more than threefold the State and county tax combined. In some agricultural counties of Michigan such a tax would exceed the State and county tax fivefold. A farmer assessed at $10,000 would have to pay $85 a year, and one assessed at $20,000, $170 a year, an amount about equal to the total store expenditures of many well-to-do farmers.

Before our farmers vote to abolish the toll that foreign manufacturers pay for the privilege of selling their goods in the American market, it might be well for them to decide in their own minds whether they pay the bulk of the import duties, or the wealthy class who consume imported goods; and whether in the direct taxation scheme the farmer's land, or the bonds and stocks of the capitalist, would be most likely to escape the United States assessor. Any farmer can figure out this simple problem for himself. Under the new order of things he can even ascertain exactly his proportion of the tax. It is a phase of the tariff question that must not be overlooked.

How does this question affect the men and women engaged in manufacturing, mechanical, and mining industries and transportation in the United States? The time has come for this army of 4,400,000 persons to examine free trade and protection for themselves. Our imported manufactured goods come chiefly from Great Britain, France, Germany, Austria, Italy, Spain, Portugal, Belgium, Holland, and Scandinavia. In these countries over 31,000,000 men and women are engaged in manufacturing and mining pursuits. The average annual income of these millions is less than $4 a week, or $200 a year. Unless they emigrate to the United States, they have no hope to rise from the condition to which they were born.

The official returns of these countries bring out the astonishing fact that over 8,000,000 persons, a number exceeding one-fourth of the industrial population, are returned as paupers, and that annually the taxpayers, already burdened with the immense cost of imperial armies, have to pay the enormous sum of $150,000,000 to prevent these people from dying of starvation. Of this amount free trade Great Britain alone contributes over one-third, or $50,200,000. So terrible has the fight for existence become in these countries, that every year thousands who can scrape together a few dollars leave their homes in the old world and cast their lot with us on this side of the Atlantic. From the British Isles alone, during the last ten years, have come 1,333,247, and from the other nations of Europe 2,359,468, making a total of 3,892,715, equaling almost, in point of number, the population of Holland. With the same environments, with the same institutions to bring out their higher manhood, the citizens of the republic extend a welcome hand to this tremendous army of emigrants.

But we are not ready to extend this same privilege of competition to those who still remain in other nations; to men who are living in different surroundings, who have not been educated up to the plane of the American workman; but who are content to slave on through life as their ancestors have done before them; who are chained to the forge, the mine, the loom, and the despotic ruler; without hope and without future. Yet this is what free trade, or the denationalization of the United States, demands of the American workmen. To support this demand, the workingman is made the victim of the most extravagant statements; he is told that the purchasing power of his wages will increase the moment he begins to compete even-handed with the 30,000,000 poorly paid workers of Europe. He is told the "pauper labor cry" is a myth, and yet before him troops the gaunt host of 8,000,000 men and women dependent on charity. With wages varying from 50 to 150 per cent higher in the United States than in Europe, the workingman pays less for his necessaries of life.

I cannot do better than quote from Mr. Ellis Robert's recent lectures before Cornell University, as he makes this point remarkably clear. He said: "Beef, pork, and poultry are cheaper with us, and so, the country through, are tea, coffee, and even sugar at retail. The Liverpool market fixes the price, not of grain in general, as is often said, but of our surplus. Our own price determines whether there will be any surplus or not. The American buys his cotton fabrics as cheaply as anybody. Anything made of wood which is higher here than elsewhere must be a curiosity or something which takes value from age. We are constantly exporting leather and many of its products. In many of the products of iron we excel other nations, and in steel we are at the forefront. In iron our progress is the most rapid. Many of our tools are cheaper than the English. Tea and coffee are sold in this country cheaper than anywhere in Europe, and certainly much more so than under the heavy British duties. Sugar pays a very high duty in the United States, and yet such are the facilities for refining here that our retail prices are as low as those of Britain. At an equal distance from the mines, coal is sold as cheaply in this country as in Britain. The most careful study will prove that all articles of prime necessity, including food in the essential varieties and the comforts of life, are cheaper here, not only in their relation to wages, but in money, than in any other country.

"When a family starts to set up a home in this country, it will find that for furniture and cutlery, and the miscellaneous articles necessary, it will be charged as low rates as in any part of Britain or Europe. Plain pottery is as cheap, glassware twenty per cent cheaper, coarse carpets and blankets are as cheap here as elsewhere. A like equipment for a house is to be bought for as little here as in Britain. The savings here on food will pay for the small share of the earnings appropriated to silks and woolens, of which the prices are higher. Rent is not more here than in Britain or Europe, under like conditions, though our people demand better accommodation, and naturally have to pay for it. Our studies show that for three-fourths of the usual expenditures of a family, the prices are in favor of the United States. The money cost is actually less here than in the land of lower wages, and with like comforts the expense is on the whole lower in this country. Even the exceptional articles tend downward in the United States as nowhere else."

Our experience vindicates the policy of protection; its strength lies in the prosperity it has given the nation; in the great industrial cities it has built up; in the prosperous and diversified industries it has founded; in the profitable home market it has given our farmers; in the varied employment it has given the men and youths of the country; in the homes and profitable work it has offered our kin beyond the sea.

In all that goes to make a nation strong and prosperous; in all that goes to make a country great and independent; in all that goes to broaden the horizon of the laborer, increase his earnings, cheapen the cost of what he buys, and improve his condition—in all this lies the strength of the protective system. Firm in the convictions of our leading thinkers, deeply seated in the experience of the country, strong in the hearts of the majority of people, and laden with evidences of its rich fruit, it is not likely the American system, shaped by the same hands that built the republic, is to be wiped out for a system which in the earlier days of our national existence was known as the "Colonial Policy," and to-day as the "Manchester School," or "Free Trade."

The cause of protection is the people's cause; it affects the vast masses of the people, and they must and will understand it. It cannot alone be studied in the lecture room. It can be studied in the light of the experiences of other nations, and in the experience of our own country. In this way I have attempted to present the facts, which must speak for themselves. As an inquirer after the truth, I have traveled thousands of miles through the industrial regions of Europe and our own country, and in this spirit of inquiry, and with no pretensions to political economy, I submit this address, earnestly believing with Henry Clay that, "The cause is the cause of the country, and it must and will prevail. It is founded on the interests and affections of the people. It is as native as the granite deeply embosomed in our mountains."

WAGES AT HOME AND ABROAD IN SOME TEXTILE INDUSTRIES.

OCCUPATION.	AVERAGE WEEKLY RATE OF WAGES PAID IN WOOLEN FACTORIES.			
	United States.—Massachusetts District.*	France.—Rheims District.†	England.—Yorkshire District.‡	Germany.—Rhenish District.§
WOOL SORTERS.				
Men	$9.43	$5.82	$5.76	$5.50
Women		2.70	2.40	2.50
Young persons	5.12	2.00	1.80	1.90
SPINNERS.				
Men (overseers)	12.60	6.50	6.00	6.60
Spinners	9.05	6.00	5.00	5.25
Women	6.18	3.00	3.00	3.00
Young persons	4.81	2.00	1.80	1.90
Piercers	5.00	3.00	2.50	2.40
WEAVERS.				
Men	8.53	4.67	4.80	4.25
Women	7.45	4.00	3.48	4.00
Mechanics	13.43	6.25	5.50	5.60
Laborers	8.58	3.75	3.25	3.00

* Report of Bureau of Statistics, Massachusetts, 1882.
† Compiled by Consul Frisbie, from books of manufacturers, 1882.
‡ Report of Robert Giffen, Statistical Department, Board of Trade, 1882.
§ Compiled by Consul Du Bois, from books of manufacturers, 1882.

We have a table here, founded on the careful work of four responsible authorities. If they tell the truth, the fact is established that in the important woolen districts the wages of England and the Continent are alike; that protective France and Germany, with their new tariffs, have increased the well-being of their workpeople, while Great Britain has done the reverse by opening her ports. The table establishes that wages are about 100 per cent greater in this industry in the United States than in any of the European countries. To abolish the duties that secure this to the workingman of the United States would result as it has done in England—in a leveling of wages.

AVERAGE WAGES HERE AND IN GREAT BRITAIN.

Below I print what Mr. Carroll D. Wright, of the Bureau of Statistics of Massachusetts, calls the general average weekly wages paid to all employes in Massachusetts and Great Britain in 1883:

INDUSTRIES.	GENERAL AVERAGE WEEKLY WAGES PAID TO ALL EMPLOYES.	
	Massachusetts.	Gt. Britain.*
Agricultural implements	$10.25	$8.85
Artisans' tools	11.80	4.89
Boots and shoes	11.63	4.37
Brick	8.63	4.16
Building trades	14.99	7.21
Carpetings	6.08	4.11
Carriages and wagons	13.80	4.89
Clothing	10 01	6.71
Cotton goods	6 45	4.66
Flax and jute goods	6.46	2.84
Food preparations	9.81	2.72
Furniture	11.04	7.96
Glass	12.28	6.94
Hats—fur, wool, and silk	11.01	5.51
Hosiery	6.49	4.67
Liquors—malt and distilled	12.87	12.66
Machines and machinery	11.75	6.93
Metals and metallic goods	11.25	7.40
Printing and publishing	11.37	5.52
Printing, dyeing, bleaching, and finishing cotton textiles	8.67	4.94
Stone	14.39	8.58
Wooden goods	12.19	5.67
Woolen goods	6.90	4.86
Worsted goods	7.32	3.60
All industries	$10.31	$5.86

* "Average" instead of "high" wages rates for Great Britain.

It will be seen from this table that the average wages to all employes for the twenty-four industries considered in Massachusetts was $10.31 a week, while that for Great Britain is $5.86 a week—the wages in Massachusetts thus being nearly double the average weekly wages paid in the same industries and to the same class of employes in Great Britain.

SOME genius has been calculating values as related to human energy in various departments of life, and cites the following illustrations: "The British Poet Laureate can take a worthless sheet of paper, and by writing a poem on it can make it worth $65,000; that's genius. Vanderbilt can write a few words on a sheet of paper and make it worth $5,000,000; that's capital. The United States can take an ounce and a quarter of gold and stamp on it an eagle bird,' and make it worth $20; that's money. The mechanic can take the material worth $5 and make it into a watch worth $100; that's skill. The merchant can take an article worth 25 cents and sell it for $1; that's business."

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ENGINEERING INVENTIONS.

A sectional steam boiler has been patented by Mr. Lawrence W. Chadwick, of Milnes, Va. This invention covers an improvement on a former patented sectional boiler of the same inventor, and consists in the combination with the vertical pipes of vertical pendent water leg pipes depending from the upper chamber, and having a fire flue through the same and a lateral connection with the other vertical pipe.

A railroad tie has been patented by Mr. Arnold N. D. Delffs, of Bedford, Tenn. The bed pieces are made of beton concrete, so moulded as to have one or more iron rods or wires embedded in the material, extending through the whole length of the tie, to strengthen it, combining concrete, iron, and wood, to make a tie that is strong, sufficiently elastic, and at moderate cost.

A reversing gear for engines has been patented Mr. Thomas Moore, of O'Fallon, Ill. A spiral shaft is journaled in disks on the shaft, having at one end a crank engaging with an eccentric disk, a spiral shaft passing through a sliding disk on the shaft, so by sliding the disk the spiral shaft is turned and its crank moves the eccentric disk and adjusts it as may be desired.

A car coupling has been patented by Messrs. William H. Adams and James D. Felthousen, of Albany, N. Y. The coupling head has flaring mouths and slots, with beveled forward ends in its upper and lower sides, the hook having a slot in its rear end, with two link seats in its throat and a projection on its lower side, so the coupling will sustain the draught strain securely, and the cars will couple automatically when run together.

MECHANICAL INVENTIONS.

A ring spinning frame has been patented by Mr. Jean B. Rolland, of Paris, France. This invention relates to parts adjoining the spindle, and has for its object to facilitate the stopping of the spindle when it is desired to join or piece broken threads, and to effect the thorough lubrication of the spindle.

A die block has been patented by Mr. Geo. W. Simmons, of Brockton, Mass. It consists of a series of cubical blocks with two central apertures crossing each other, and a bolt passing through one of the apertures, so the blocks may be reversed to present any of their faces to form a new surface.

A bolt dresser has been patented by Mr. Henry Egeberg, of Napa, Cal. It is a machine which can be more conveniently applied to the bolt than the ordinary stocks and dies, and is composed of two hinged jaws having on one end removable dies and at the other end an expanding screw provided with a spring cover, in which dies of different sizes may be kept.

MISCELLANEOUS INVENTIONS.

A surgical device for relief of hemorrhoids and similar affections has been patented by Mr. Lewis Chamberlain, of Tarborough, N. C. It consists of a seat formed with an ovoid, concave, and a central aperture, the size to be proportioned to the individual.

An anchor has been patented by Mr. Peter C. Herman, of Dartmouth, N. S., Canada. The flukes project from the bottom and top surfaces in such a way that, in whatever position the anchor drops, one of the flukes will always catch on the bottom.

A corkscrew has been patented by Mr. Martin F. Williams, of Bastrop, La. In combination with a bracket adapted to hold a bottle is a lever projecting over the bracket and a corkscrew held to turn in the lever, with various other novel features.

A detachable fur collar has been patented by Mr. Charles F. Butterworth, of Troy, N. Y. It is formed of a single piece and made to fold longitudinally, having its skin of increased fullness on one side of the fold, the lining strips being cut and folded to present reverse concaves.

A hydraulic jack has been patented by Mr. Elnathan Hall, of Latingtown, Glen Cove, N. Y. This invention consists of the adaptation of a former patented jack for lifting weights on a plane below itself, thereby greatly extending the applications and uses to which it may be put.

A two wheeled vehicle has been patented by Messrs. Enoch P. Hincks and George H. Johnson, of Bridgeport, Conn. It has a three-sided front, two of the sides of which are doors hinged in the rear to open on or toward the wheels, and the driver's seat is in the rear of the carriage.

A shaft loop has been patented by Mr. Edwin D. Moseley, of Shopiere, Wis. It is made of metal with a convex or rounded inner surface, and has a claw on its upper side, with a billet at the front and one on its under side, the claws being double or single according to the kind of buckle used.

A razor has been patented by Mr. James P. Tryner, of Denver, Colo. This invention consists in mounting one or more set screws on the razor guard, and loosely connecting them with the back of the razor, so that by turning a screw the blade may be adjusted in either direction.

A centrifugal machine for drying hides and skins, spent tan and other matters has been patented by Mr. Emil de Solminihac, of Pont Aven, France. It is a rotary skeleton drum of spaced apart bars having clips or means to stretch the hides or skins upon the circumference, the drum having a wirework lining.

A broiler has been patented by Mr. George B. Siegenthaler, of Wooster, Ohio. This invention provides for a broiler so made that it may be held down in a stove hole closer to the fire than is the case with ordinary broilers, thus enabling meat to be broiled or bread toasted in less time.

A substitute for caoutchouc has been patented by Mr. John J. Haug, of St. Petersburg, Russia. It is prepared by boiling skins and glycerine under pressure, and mixing with the mass obtained glycerine and chromate or bichromate of potash or other salt acted on by light, with or without the addition of ground cork, ox gall, and color.

A cartridge implement has been patented by Messrs. William G. Jesse and George E. Paxton, of Georgetown, Ky. It is a simple device for removing spent caps from discharged cartridge shells, and reloading and recrimping the same, the parts being easily separable, so that the apparatus may be conveniently carried by sportsmen in the pocket.

A telegraphic transmitter for unskilled operatives has been patented by Mr. Theodore Ames, of Hackensack, N. J. By this apparatus a person wishing to telegraph depresses the corresponding keys in the same manner as in operating a type writing machine, but the receiver must have a knowledge of the Morse characters.

A corrugated pan for salt making has been patented by Mr. Joseph A. Cook, of Auburn, N. Y. The pan is made of boiler plates or cast sections to be bolted together with longitudinal corrugations, and the salt crystals are drawn from the bottoms of the corrugations by endless belts of cloth or other suitable material, to which are attached cross cleats.

A gas making machine has been patented by Messrs. Abel and Thomas Henning, of Sacramento, Cal. This invention covers novel details of construction and arrangement for an automatically working machine to make gas out of gasoline, feeding itself so as to give a steady supply, and so there will be no danger of any gas escaping.

A drain and sewer pipe has been patented by Messrs. John Cooper and Henry Bieg, of Brooklyn, N. Y. The pipe section has at one end a flange forming a socket with internal annular grooves, and at the opposite end external annular grooves and a tapered neck, so the joints can be well cemented, while the pipe is very strong and durable.

A transom lifter has been patented by Mr. Samuel A. Bishop, of Smithport, Pa. This invention relates to devices for opening and closing transoms, skylights, and other windows that are out of reach, and is a device for holding the transom when closed, to apply power advantageously in opening it, and to hold it braced in the open position.

A brick kiln has been patented by Mr. Thomas M. Bannister, of Lone Pine, Cal. This invention provides for furnaces arranged in the front and rear walls of a brick kiln, with top openings having tilting automatically closing valves, and car tracks arranged along the front of the furnaces, with various novel features.

A fruit jar has been patented by Mr. John J. Quinby, of Armonk, N. Y. It has a long neck, a shoulder at the bottom of the neck, and two diametrically opposite quadrant ridges a short distance below the shoulders, with a cover having a shoulder and similar ridges to hold the cover on the jar, and close very tightly, to make the jar air tight.

An improved brick wall or pavement forms the subject of a patent issued to Mr. Louis R. Sassinot, of New Orleans, La. The invention consists in forming walled receptacles or chambers by arranging certain of the bricks edgewise, and afterward lining the chambers with a plastic substance, and filling them with a concrete mass having a waterproof surface.

A hame has been patented by Mr. Daniel H. Grant, of Raymore, Mo. It is made in sections arranged to be adjusted edgewise to a greater or less curve to suit the collar and the shape of the horse's neck, the central section having a removable plate and eye or staple for holding the hame tug, the staple being adapted to be adjusted for raising or lowering the draught.

An apparatus for securing animals while being shod has been patented by Mr. James H. Lewis, of Bismarck, Ill. It is made of hinged beams, with posts and braces, with bearings to receive rods attached to the ends of a strap or straps, one of the rods having a ratchet wheel, pawls, and a lever, for tightening and loosening the straps, and supporting or releasing the animal.

A projector stopper for bottles and flasks has been patented by Messrs. Georges Pinaud and Pierre Guichard, of Paris, France. It is a system of stopper and cork to use with all kinds of bottles or flasks, for projecting the liquid, by pressure applied to a hollow India rubber ball fixed to the top of the stopper, whereby the liquid may be projected in one or more jets according to the number of holes in the ball.

A means for assisting persons in putting on outside wrappings has been patented by Mr. Greenup Sutton, of Rushville, Mo. It consists of a framework with clamping jaws for holding the coat collar, a treadle for operating the jaws, and hooks or supports for distending the sleeves of the garment, the apparatus being especially designed for feeble persons, cripples, or those not well able to wait on themselves.

An air pump has been patented by Mr. Hermann Meckert, of Hannibal, Mo. It consists of an outer rigid metal cylinder and an inner cylinder of flexible material, impervious to air, secured to one end of the outer cylinder and to a piston working therein, so that when the inner cylinder is being extended air is drawn into it, and by compressing the cylinder the air is compressed and expelled.

A turn table for horse cars has been patented by Charles F. Bollwitt, of New Orleans, La. It has a pivoted locking bolt to engage with catches on the platform surrounding the turn table, a lever being under the locking bolt, which can be shifted by devices operated automatically by the turning of the turn table, and adjusted so as to lock the turn table in any desired position.

An apparatus for distilling low wines has been patented by Messrs. Nels Peterson and Henry Sommer, Jr., of Davenport, Iowa. There is a receiving tub over the still, a charge pipe communicating between the tub and the still, a vapor pipe communicating with the stock tub, and various other novel features to better adapt a distilling apparatus to the manufacture of vinegar.

A truck skid for railroad cars has been patented by Mr. Adolphus E. Kiel, of Montrose, Iowa. It is fitted to slide in ways beneath the car, and tied to it by a chain connected at one end to the skid by a bail, having a ring at the other end, which slips along a bar fixed to and running crosswise of the car, so the skid may be run out for use at either side of the car, and may be run into the car to receive the load and out again to discharge it.

NEW BOOKS AND PUBLICATIONS.

THE MAGAZINE OF ART (Cassell & Co.), New York, for October is rich in papers and pictures for artists and art lovers. The head of Christ, from a cartoon by Lionardo, illustrates a good article by Julia Cartwright. It contains descriptive and critical text, with sketches of some of the works in the last Royal Academy exhibition. There are several historical articles on art and artists, and the usual good summary of art news in the concluding pages of the number.

SCRANTON, PA., CITY DIRECTORY. Lant & Silvernail, compilers, Valatie, N. Y.

The review of the city's growth and the exhibition of its business given in the preface furnish a chapter worthy of remark, even in this fast growing age and country. In 1860 the population was but 9,223; in 1884 it had grown to 67,062. The city is located in the center of a great anthracite coal field, and coal, iron, steel, and lumber make the principal staples, which, with the most ample transportation facilities, seem to give good promise of a continuous rapid growth in the future.

HARPER'S MAGAZINE.

The October number is well stocked with interesting matter, and with its sixty well executed engravings presents a very attractive appearance. The pen of Mr. John Macmullen, who has for a lifetime been engaged in educational work in this city, has produced a most interesting article on the founding of Kings College, which title was the name of Columbia College previous to the Revolution. The name was changed in 1784. Mr. Macmullan gives some very interesting reminiscences of the college and its presidents previous to the Declaration of Independence. According to the writer, the earliest mention of Kings College to be found is in 1703, when the rector and wardens of Trinity Church were called upon by Lord Cornbury, then Governor, to know what part of Kings farm, then vested in Trinity Church, had been intended for the proposed college. To the alumni of Columbia College this well written article will have peculiar interest.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Clark's Rubber Wheels. See adv. next issue.

Of the very choicest tobacco leaf—choicest because the firm can command it—is made Blackwell's Durham Long Cut. Gentlemen may regale themselves with a pipe, or roll it into fragrant cigarettes. Either way it is the most luxurious of all tobaccos. Trade mark of the Durham Bull.

1 H. P. Horizontal Steam Engine for sale. New; fitted with governor and all fixtures; cost, $80.00. Will sell at big discount. Address E. T. Shaw, Beverly, Mass.

Blake's Patent Belt Studs, the strongest and best fastening for Rubber and Leather belts. Greene, Tweed & Co., N. Y.

All books and everything relating to electricity cheap. School of Electricity, N. Y.

For Sale.—A patent right of Weighing Scales for any purposes. Address T. Ziersch, Dedham, Mass.

For Sale.—Eighteen volumes of SCIENTIFIC AMERICAN—1866 to 1874 inclusive. Address Box 244, Lancaster, Pa.

Advice to Dyspeptics. By one who cured himself. Mailed free. J. H. McAlvin, Lowell, Mass. 14 years Tax Collector. Send for it.

Mechanics and others send for Prospectus. Sons of Labor League, Canton, O.

Shafting For Sale.—Excellent 2d hand, with its couplings and coupling bolts all fitted, true, and polished; with or without hangers, as customer may prefer; any part or all; 144' 4''; 224' 3⅞''; 216' 2⅞''; 24' 2½''; 16' 2 3-16''; 12' 2⅛''; 160' 1 15-16''; 32' 1⅞''; 53' 1 7-16''; 27' 1⅜''. Send for full particulars and prices per lb., stating size and amount required. Forsaith Machine Co., Manchester, N. H.

For Sale.—Two new, first class engine lathes; each back-g'd, sc.-cut., rod-f'd, power cross f'd, compound rest, full counter, friction pulleys, center rest, face plates, etc. One 16' x 26'', $625; one 16' x 20', $416. E. Cornish, Manchester, N. H.

Required.—Cash capital of $5,000 to advertise and introduce a valuable patented invention for saving power and economy of space in all kinds of Belt Driving machinery. This patent has already been adopted by one of the principal electric light companies of this country, and is in use in England and France. Attention of a manufacturer with the above amount to invest is especially solicited to this splendid opportunity for a good investment. For full particulars apply to S. Samper & Co., No. 134 Pearl Street, New York.

Cotton, Rubber, and Leather Belting. Steam Engine Packing of all kinds. Greene, Tweed & Co., 118 Chambers St., New York.

The Cyclone Steam Flue Cleaner on 30 days' trial to reliable parties. Crescent Mfg. Co., Cleveland, O.

For Steam and Power Pumping Machinery of Single and Duplex Pattern, embracing boiler feed, fire and low pressure pumps, independent condensing outfits, vacuum, hydraulic, artesian, and deep well pumps, air compressors, address Geo. F. Blake Mfg. Co., 44 Washington St., Boston; 97 Liberty St., N Y. Send for Catalogue.

Quinn's device for stopping leaks in boiler tubes. Address S. M. Co., South Newmarket, N. H.

Mills, Engines, and Boilers for all purposes and of every description. Send for circulars. Newell Universal Mill Co., 10 Barclay Street, N. Y.

Wanted.—Patented articles or machinery to manufacture and introduce. Lexington Mfg. Co., Lexington, Ky.

Brush Electric Arc Lights and Storage Batteries. Twenty thousand Arc Lights already sold. Our largest machine gives 65 Arc Lights with 45 horse power. Our Storage Battery is the only practical one in the market. Brush Electric Co., Cleveland, O.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 86 John St., New York.

Stationary, Marine, Portable, and Locomotive Boilers a specialty. Lake Erie Boiler Works, Buffalo, N. Y.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

The Hyatt filters and methods guaranteed to render all kinds of turbid water pure and sparkling, at economical cost. The Newark Filtering Co., Newark, N. J.

Send for Monthly Machinery List to the George Place Machinery Company, 121 Chambers and 103 Reade Streets, New York.

Steam Boilers, Rotary Bleachers, Wrought Iron Turn Tables, Plate Iron Work. Tippett & Wood, Easton, Pa.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN Patent agency, 361 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Drop Forgings. Billings & Spencer Co., Hartford, Conn.

Electrical Alarms, Bells, Batteries. See Workshop Receipts, v. 3, $2.00. E. & F. N. Spon, 35 Murray St., N. Y.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 East 8th Street, New York.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Emerson's 1884 Book of Saws. New matter. 75,000. Free. Emerson, Smith & Co., Limited, Beaver Falls, Pa.

Barrel, Keg, Hogshead, Stave Mach'y. See adv. p. 173.

Munson's Improved Portable Mills, Utica, N. Y.

Solid and Shell Reamers, durable and efficient. Pratt & Whitney Co., Hartford, Conn.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423. Pottsville, Pa. See p. 141.

Catechism of the Locomotive, 625 pages, 250 engravings. Most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for catalogue of railroad books. The Railroad Gazette, 73 B'way, N. Y.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 142.

The Porter-Allen High Speed Steam Engine. Southwark Foundry & Mach. Co., 430 Washington Ave., Phil. Pa.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works. Drinker St., Philadelphia, Pa.

Notes & Queries

HINTS TO CORRESPONDENTS.

Name and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or mail, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) M. J. B. writes: Can any of your correspondents inform me how and where an eel was generated? A. The function of reproduction in the eel, and the general structure of the organs concerned in it, correspond entirely with the same points in our other ordinary osseous fishes. Much mystery has been attached to them in past ages, but the advance in accurate knowledge of structure has totally dispelled it. Eels breed as do cod, or perch, or shad. The first accurate description of the female organs was made by Mondini, in 1777, in a paper entitled "De Anguillae Ovariis," which was published in the proceedings of the Bologna Academy. But the structure of the male organs was not fully stated or known until they were worked out by Syrski, in the proceedings of the Imperial Academy of Vienna, in 1874. The one point which doubtless has helped in great degree to continue the mystery is the extreme minuteness of the eggs. They have only about one-tenth to one-thirtieth of the diameter of the eggs of other fishes, and in the leaf-like folds of the ovaries are constantly associated with fat globules, from which it is not easy to distinguish them. The spermatozoa are even very much more minute, and can scarcely be detected except by a practical observer, using a microscope of high power. The male eels are much smaller than the females, and never ascend into fresh water; the eggs are hatched in the sea or brackish water, and the young ascend the rivers in myriads, climbing waterfalls most wonderfully to do so.

(2) F. A. L. asks: What will take off the black stain caused by rubbing a parlor match on a

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bronze match box? A. Washing with plenty of clean water, accompanied with mechanical friction, is generally considered the best means of cleansing bronze articles. A dilute solution of the caustic alkalies is likewise recommended as desirable in removing the overlying dirt.

(3) O. J. P. asks: Is it best to oil belts running machinery—dynamos for instance? If so, what kind of oil is best, and should it be put on inside (next pulley) or not? A. A little neatsfoot oil once in a while, to keep the leather from getting too dry; use as little as possible, on both sides, and give it time to be taken up by the leather.

(4) W. D. S. asks if a diamond shaped block can be made of one piece, having eight diamond faces. A. If you intend to have the diamond shaped faces flat and all of one size, we think it cannot be done.

(5) C. P. writes: I have fixed up an old mahogany desk; after scraping I rubbed it with raw oil and shellac, which leaves it streaked and with a dull surface; what shall I use for a finishing polish? A. Mix equal parts of thick alcoholic shellac, varnish and boiled linseed oil, and shake well together before using. Rub a small quantity of this mixture vigorously over the wood until the desired polish is secured.

(6) W. H. W. says: I see in your paper of August 2, you say 6 square feet of fire surface for 2 inches by 4 inches cylinder. Now for 6 square feet fire surface how large a horizontal boiler should I have, that is, what diameter, what size tubes, what length tubes, and what thickness iron for boiler? A. For your boiler, a cylinder 12 inches diameter, 2½ feet long, with 12 tubes 1¼ inches diameter, shell $\frac{1}{4}$ inch thick. Heads ¼ inch thick, tubes in lower half of heads. A miniature of the large horizontal tubular boilers.

(7) J. C. R. asks: How many foot pounds can be realized from one cubic foot of water made into steam and used through a steam siphon? A. From 3,000,000 to 4,000,000 foot pounds theoretically. You will probably not realize more than one-fifth of this in a steam siphon.

(8) C. M. W. asks about a formula for removing blackheads. A. On page 52 of the SCIENTIFIC AMERICAN for January 28, 1882, there is given very fully a description of the method used for the extraction of comedones. The articles there given are not injurious to the skin.

(9) O. S. B. asks how much pressure he would gain under the following conditions: A tight cast iron box is filled with air of 60° temperature, at a pressure of 30 pounds, and the intention is to heat it to 200° of heat. A. Air at 60° and 30 pounds pressure, and of a given volume, if heated to 200°, will increase the pressure to 38 pounds.

(10) H. W. T. asks how to construct a dumb waiter or elevator to elevate one or two hods of coal, say 50 pounds, from cellar to next story above with little exertion of strength. A. These elevators are nothing more in construction than a sort of hung platform or box partly balanced by weights, which most good carpenters understand. We recommend you to consult with some builder in your city. We cannot illustrate it in Notes and Queries.

(11) E. T. F. says: I wish to have some bells cast; how can I make my models out of wood, in order to obtain the desired weight in iron? A. If there are no core prints, the casting will weigh 16 times the weight of the pine pattern, if solid. For core prints and cores deduct 0·26 of a pound for each cubic inch from the completed weight of the whole.

(12) G. H. says: I want to make a telescope with a 3 inch object glass, 48 inch focus. What length should the body be, and would brass tubing an eighth of an inch thick be strong enough? What diameter should the focusing tube be and what length? A. Make the body of your telescope about 42 inches in length, and your focusing tube about 10 inches in length and 1½ inches in diameter. A tube one-sixteenth of an inch thick would answer for the body.

(13) A. A. asks (1) how to make a good and reliable rubber cement for soling and mending rubber boots. A. Dissolve pure, unvulcanized rubber in bisulphite of carbon or in benzine of turpentine. 2. What would be the most substantial way of patching rubber, that is hollow with great pressure, like a hose? A. Clean the surfaces thoroughly, apply the cement to the patch and to the surface to be patched, and hold the patch in place with considerable pressure until the cement is set. 3. Could I not dissolve crude rubber with odds and ends of vulcanized rubber and mix with sulphur and other articles, so as to make a solid dough or the composition hard and durable for soles for rubber boots at any thickness I desire? A. Vulcanized rubber cannot be entirely dissolved. It may be softened by any of the solvents of unvulcanized rubber.

(14) S. F. asks how to draw a picture on glass, for magic lanterns—the substances to be used for different colors and the way to use them. A. Very fine pictures may be drawn for the magic lantern with an ordinary lead pencil on ground glass, afterward varnishing the glass to render it transparent. If you desire to make colored pictures for the lantern, you may use any of the transparent tube colors, mixing them with varnish. You will find information on this subject in SUPPLEMENTS, No. 423, 173, and 424.

(15) A. A. S. writes: I recently attended a lecture on "The Great Atmospheric Weight" on the human being. Suppose a man could be so arranged as to have the air entirely exhausted from aronnd his body, can you tell what his feelings would be? Appliances being arranged so that he could breathe. A. He would feel like bursting, if there were time enough of sensation to have any feeling, for the air inside the body would distend all and rupture a great many of the cells.

(16) K. O.—We know of no electric railway velocipede. We think it would hardly be practicable unless you are able to generate current by means of a dynamo as in electric railroads. We do not know that the limit of speed for electric tricycles has been attained. It depends, of course, upon the power of the engine and the currents applied to it. It will probably require a one horse power motor to drive an ordinary tricycle.

(17) W. C. M.—Benzine or gasoline can be congealed by means of freezing machines, several of which are manipulated by means of ether and ammonia. As far as we can ascertain, the process is not a practical one, as there is no commercial demand for these articles in a congealed form. No acid would be necessary to cause it to resume its normal condition. The action is due to a frigorific and not to an emulsifying agent.

(18) J. S. T. asks if on the coast of this country such fishes are to be caught as the imported celebrated Swedish so-called "delicatess anjovis," and if so, where? A. The menhaden or alewives, found mostly on the coast of Maine and Nova Scotia, are very similar, although usually they are not so choicely put up. 2. Do you know any factory in this country preserving such fishes? A. There are several factories "down East" for putting up these fish, both as anchovies and sardines.

(19) J. W. T. asks (1) for a cement or paste to put patches and soles on rubber boots, and how to apply it so as to be durable. A. Use rubber cement which is, by digesting caoutchouc, cut in fine shreds, with about 4 volumes of naphtha in a well covered vessel for several days. Naphtha should not be used indoors. 2. Is there a work that treats on the shoeing of interfering horses, and if so, where can I get it? A. There is a work by Russell on Horseshoeing, which cost 75 cents, that we can furnish you with.

(20) W. L. asks how to make oxymuriate of antimony, such as used by dyers as mordant for cotton. A. The best method for preparing the oxychloride of antimony is to boil the commercial sulphide of antimony in fine powder with hydrochloric acid, till the liquid is saturated, hydrogen sulphide escaping all the while; leave the solution to cool; add to it, with agitation, small portions of water till it begins to show turbidity, then filter; mix the filtrate with 5 to 10 times its bulk of water, and wash the resulting precipitate thoroughly with cold water by decantation or on the filter. The addition of a small quantity of water and filtration before the complete precipitation is necessary, in order to remove a small quantity of hydrogen sulphide, which always remains in the acid liquid, but is carried down by the first portions of oxychloride precipitated and thereby removed; if allowed to remain, it would cause the precipitate to turn yellow.

(21) A Reader writes: 1. I have two light yellow straw hats I wish to dye, one brown and the other dark blue. Will the Diamond dyes do for the purpose, and will the hats be as glossy as new? A. The Diamond dyes are not satisfactory for the purpose mentioned. For brown, dye with Bismarck brown, then immerse in a weak solution of hydrochloric acid to fix the color. For dark blue use a strong extract of indigo. The gloss is produced by varnishing with shellac. 2. How and where are plant bulbs obtained? A. Of agricultural supply and seed stores.

(22) J. T. W. writes; 1. Will the cure, formula, or receipt for removing pimples and blackheads, contained in the SCIENTIFIC AMERICAN for July 5, question 8, injure the skin? A. It is not injurious. 2. Is there any receipt for making imitation gold that will take a good color, and not tarnish, and how should it be melted? A. Oroide gold is made by taking 100 parts of pure copper, 17 of pure tin, 6 of magnesia, 9 of tartar of commerce, 3·6 of sal ammoniac, and 1·6 parts of unslaked lime. The copper is first melted, and the other substances (except the tin) added, a little at a time, and the whole well stirred for 30 minutes, so as to produce a perfect mixture, when the tin is thrown in and stirred round until melted. The crucible is then covered and the fusion kept up for 25 minutes, and the scum taken off, when the substance is ready.

(23) H. M. writes: I am told that a wheel grease is or can be made from "dead oil," a residue from distillation of coal tar, by some process of using lime with it. Can you give me any light on the subject? A. Axle grease is produced by a combination or variety of saponification between lime and resin; this yields a mixture too hard for use, and consequently it is thinned by means of dead oil, and thus made pliable. About one part of pure slaked lime is used with 10 parts of the resin oil, and a sufficient quantity of the dead oil is added. The latter is generally mixed with a little lime and water first, and then gradually mixed with the resin oil, small portions being used at a time, and the mixing continued until the proper consistency is reached.

(24) M. H. F. asks as to a few methods used in making mucilage. A. A good mucilage for labels is made by macerating 5 parts good glue in 18 to 20 parts water for a day, and to the liquid add 9 parts rock candy and 3 parts gum arabic. The mixture can be brushed upon paper while still lukewarm. See also the article on Cements, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158.

(25) C. C. B. asks how to tin small articles, and the price of the material used. A. The "small articles" are presumably of iron. They should be washed in soda or potash water to free from oil, stirred in a bath of muriatic acid, in which scrap zinc has been dissolved, the acid being then drawn off and diluted with water so as to be only slightly acidulous to the taste. Skim the articles from the acid bath, and throw them into a box of powdered resin. Then throw them into a bath of melted block tin; let them remain a few seconds, lift them out with a skimmer, and throw them against a screen of sheet iron to free them from superabundant tin. Good black "straits" or "Banca" costs about 22 cents a pound by the pig.

(26) E. S. K. asks the best way of laying a street railroad on an improved roadway. Have about two miles of track and have considerable trouble on account of its spreading. A. The practice here for street railroads is to use ties with stringers, all sawed timber, with knees of cast iron spiked to tie and stringer inside and outside of stringer. It is not necessary to have the ties sawed. Small logs with a place adzed off at each end; or if the stringers are sawed to a gauge size, the ties may be notched to receive the stringers, and a locust pin driven through stringer and tie.

(27) C. L. H. asks how to construct a spur gear pattern, proportion 6 to 1, large gear 36 inches diameter, pinion 6 inches diameter; these gears to be proportioned so as to stand the strain of one engine 6x8 inches, pressure of steam 130 pounds, revolutions per minute 350. How large boiler should two steam cylinders have—6x8, revolutions per minute 300, exhaust into the stack? A. For a pinion upon the shaft of the engine, make pinion 7 inches diameter, pitch line 6 inches diameter, bottom of teeth 4⅞ inches diameter, thickness of teeth at pitch line one-sixteenth inch less than space between the teeth; width of pinion, 3 inches; multiply by 6 for number of teeth and diameter of pitch line for large wheel; other sizes same as for pinion. For further details we refer you to a small work, "A Practical Treatise on the Teeth of Wheels." You will need about a 40 horse boiler.

(28) A. M. writes: How or in what form can ammonia be employed to raise bread? Is it as carbonate, dissolved in water cold or hot, and has it to be employed in connection with other ingredients? What proportion to the flour? A. By consulting the article by Dr. Graham on "The Chemistry of Bread Making," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 222, you will get at the whole theory of raising bread by means of carbonic acid. The ammonium carbonate is the substance generally used, dissolved in cold water.

(29) H. J. asks (1) the shortest diameter of railroad curves. A. 400′ radius on main tracks; 200′ radius for terminals—not much used. 2. The largest possible difference of level of two coupled cars? A. About 1 foot with special links; a few inches only with common links or couplings. 3. The maximal compression of buffer springs? A. Spiral springs may be compressed till the wires touch; rubber springs vary widely, according to quality.

(30) G. S. S. asks if there is a tool made for cutting tubes out of a boiler; if not, what kind of a chisel is best to use? Size of tubes, 3 inches outside diameter. A. If the tubes can be dropped to the hand hole, they may be cut off inside of the head by driving an ordinary thin cold chisel through the tube all round. Drop the tube, and pull out at the hand hole. Compress the expanded end of the short end in the head, with calking tool or blunt chisel, and drive it in. If a tube is to be taken out through the tube hole in the head, the end may be compressed with a blunt chisel applied around the end of the tube, and with a narrow cape chisel carefully cut a groove; or in other words, slit the end of the tube in 3 or 4 places, when it will easily compress under the blunt tool so as to allow of its being driven out of its bearing at the other end of the boiler, when it can be drawn out.

(31) J. W. F. says: I am dredging in salt marsh and have to boat my fresh water for boiler a long distance. What is the best form of condenser to condense salt water, and what size is required to furnish a 25 horse power boiler? A. We understand you wish to save the exhaust steam from your dredging engine, which for your 25 horse power boiler will probably use 100 gallons fresh water per hour. For the condensation of the exhaust steam use a coil of wrought iron pipe, called in the pipe trade a pedestal coil, which may be made of 1 inch pipe branching from a header of a caliber equal to the exhaust pipe, with enough pipes from the header to also equal the exhaust pipe area. The coil should contain 400 feet of 1 inch pipe, or 10 pipes wide, 6 pipes high, and 7 feet long. Place the coil in a tank, and circulate the salt water through the tank by means of a pump.

(32) A. B. says: Replying to a correspondent in your Notes and Queries of a recent number, you state the size of a balloon required to lift 100 pounds, filled with pure hydrogen, to be 12 feet in diameter. Estimating on that basis, I find the size required to lift 500 pounds to be 21 feet in diameter, and given the weight of the materials, oiled silk, cords, netting, baskets, etc., at 150 pounds, two passengers 350 pounds =500. 1. Am I approximately correct? A. Yes. 2. Would it be practicable to condense hydrogen into a suitable receptacle with a hand pump when I wish to descend, instead of allowing it to escape, and allow it to expand into the balloon again when I wish to rise, thus dispensing with ballast? A. We think not. The weight of pump and tank together with their bulk will probably be found an insuperable objection. 3. Could the entire contents of the balloon be condensed when the ascent is finished, and stored for future use? A. Yes, but would cost more than the gas is worth. 4. How much time would it be necessary to occupy in condensing the contents to avoid excessive heat in the reservoir, and excessive cold when expanding? A. This depends upon the size of the pump and power used as well as the time. It is very slow and tedious work by hand power. 5. What is the best material for confining hydrogen under pressure? A. The best material for confining the gas is iron in cylinders. Answer on page 43, July 19, 1884, is correct; a balloon is not always a ball, but holds more than a globe of a given diameter. The rule for lifting power of a balloon is also found in Haswell, page 218, new edition.

(33) C. L. desires to know (1) if there is any place in New York city where I could receive instruction in electrical engineering, on evenings during the winter? A. There is no place where electrical engineering is taught in New York. 2. Also is bee farming in California considered a profitable business, and does it pay with moderate capital? A. Bee farming in California is a profitable enterprise if suitably managed. Helen Hunt gives a favorable account of it on page 814 of the *Century Magazine* for October, 1883, under the title of "Out Door Industries in Southern California." Success depends upon the individual. The outlay need not be great.

(34) H. H. asks how much power and how large a boiler it would take to run a skiff 15 feet long, and 3 feet wide in its widest place. The skiff is to weigh about 300 pounds without machinery, and to travel about 8 miles an hour. A. Engine 2½ inches cylinder and 4 inches stroke. Propeller 16 inches to 18 inches diameter, and 26 inches to 28 inches pitch. Boiler to have about 65 foot fire or heating surface.

(35) G. B. S. asks: Will you kindly inform me what quantity of liquid slate it requires to make a black board four feet high by sixty feet long, and how it is used and quality? A. The Harvard liquid surface slating, to which we presume you refer, is sold in condition to be applied by the brush, and 1 gallon of the paint is sufficient for 2 square yards.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

Q. & Co.—Bole is a fine, compact, argillaceous earthy mineral which occurs in amorphous masses of various colors, as yellow, black, brown, and bright red, all probably derived from oxide of iron. The substance is probably disintegrated basalt. The expression is quite loosely applied, and the substance used by the North American Indians to make their pipes from was designated as bole. For the putz pomade any soft, fine clay will answer.

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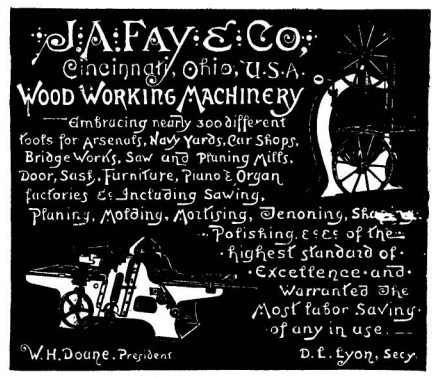
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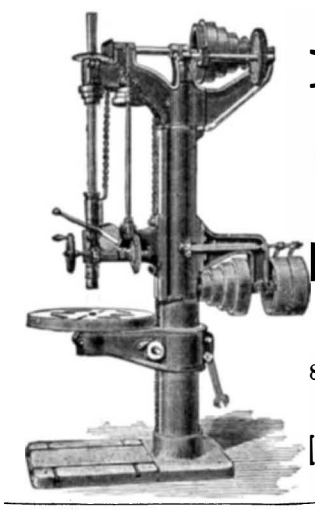

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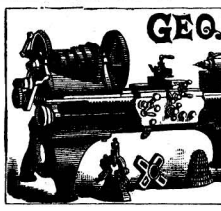
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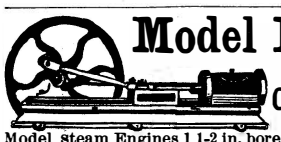
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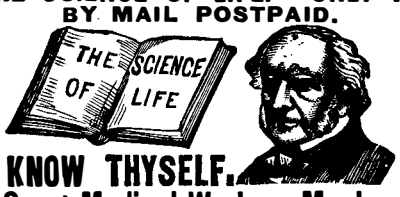

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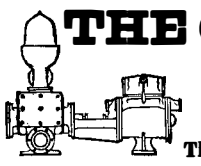

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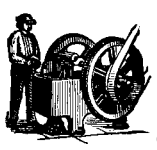

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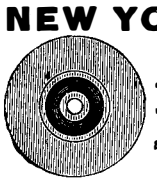

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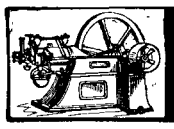

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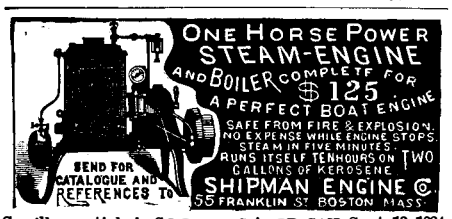
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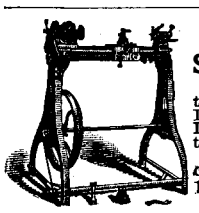

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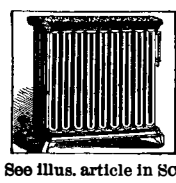

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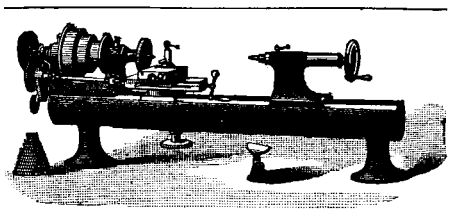

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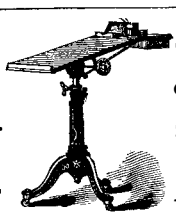

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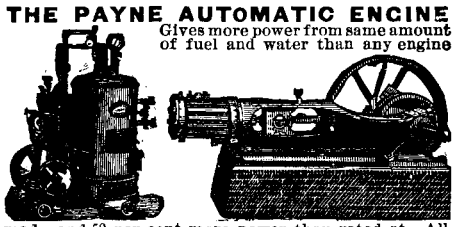

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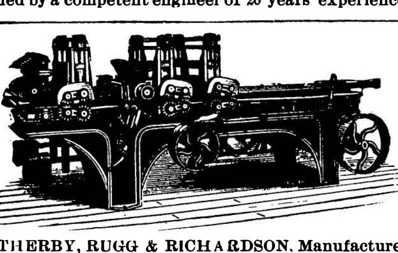

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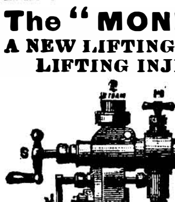

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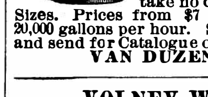
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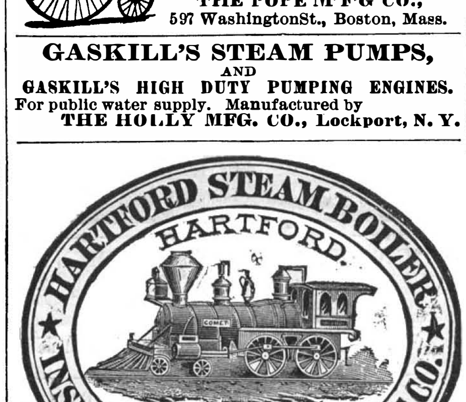

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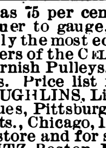
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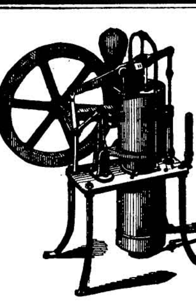
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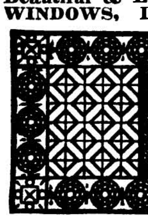
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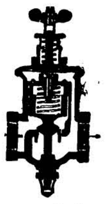
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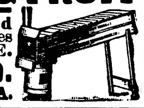
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